SAE Journal

NOVEMBER 1952

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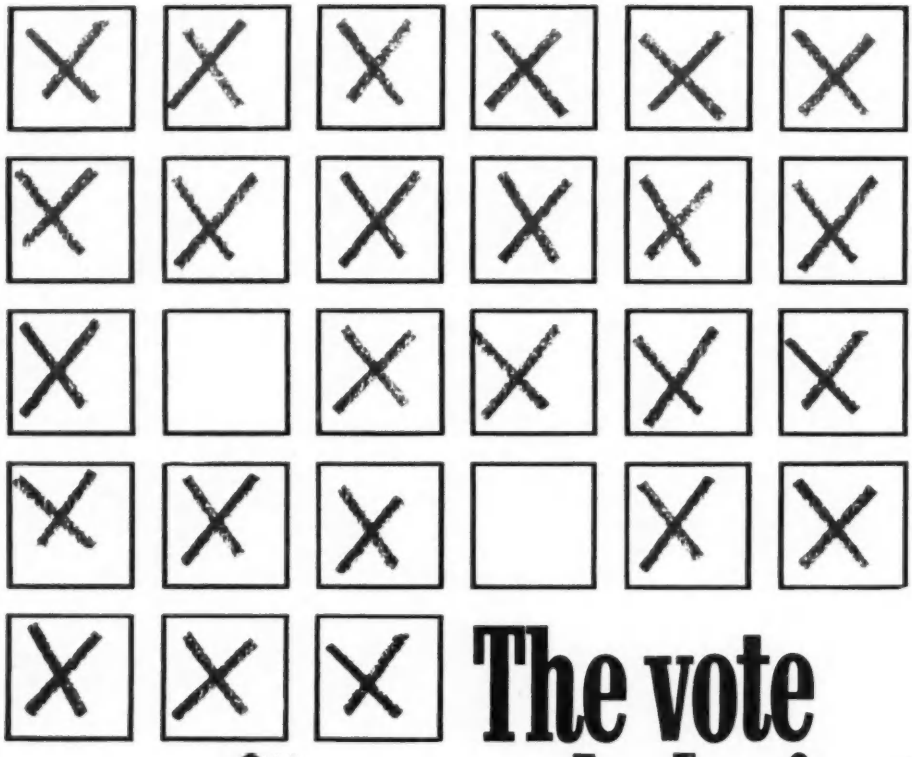


The vote is overwhelming!

Now **25** out of **27** leading engine manufacturers using chrome rings specify Perfect Circles!

SOLID CHROME PROTECTS THESE WEARING SURFACES.
Normal pressure spring and alternate HiPressure spring (for badly worn cylinders) packed with each oil ring.
Perfect Circle

Perfect Circle chrome rings are a landslide favorite with engine manufacturers . . .

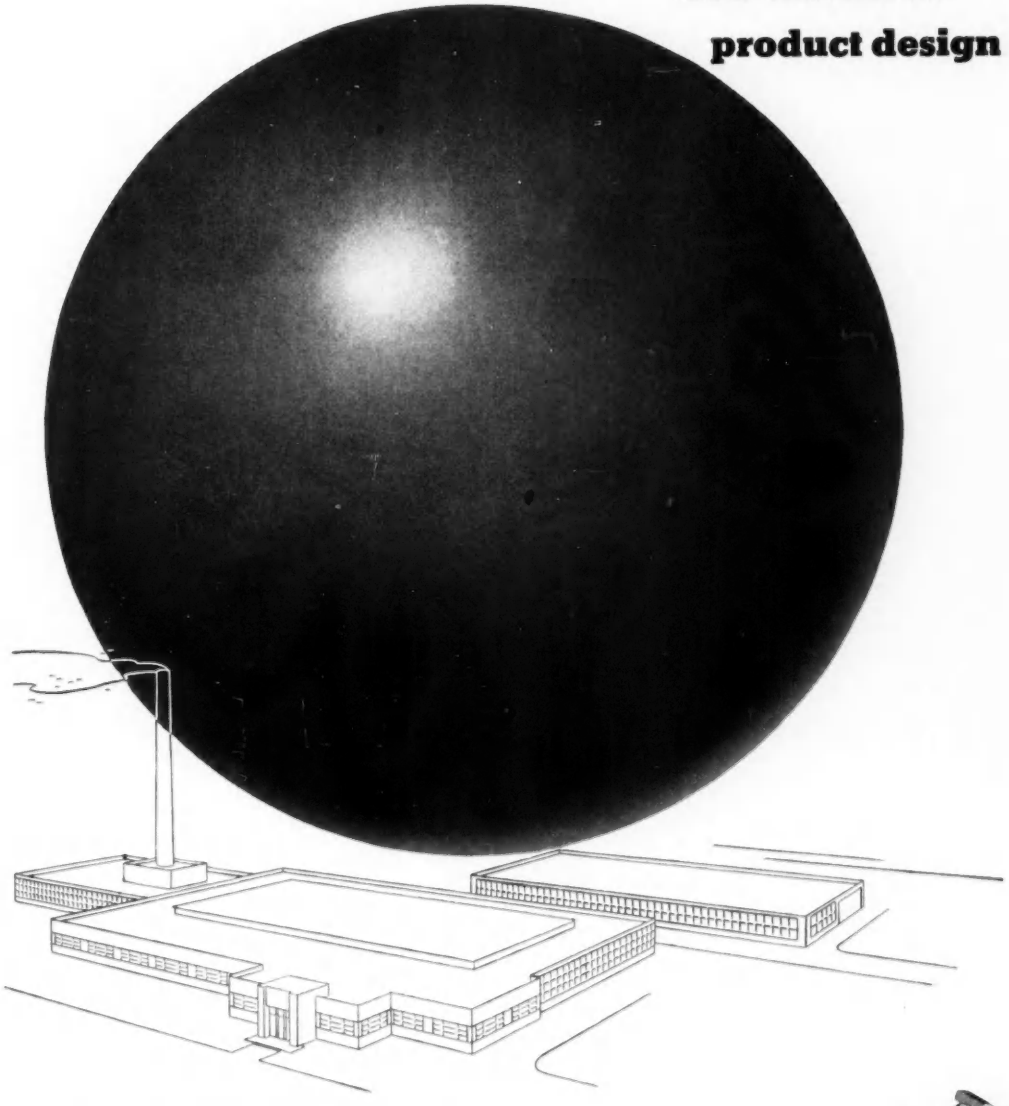
And, in replacement service, Perfect Circle's 2-in-1 Chrome Set has also established new standards of piston ring performance and popularity. The thick solid chrome plating on top compression rings and oil ring rails *more than doubles* the life of cylinders, pistons and rings . . . and 2-in-1's choice of expander springs assures sustained power and oil economy regardless of cylinder condition!

What's more, there's no tedious break-in period with 2-in-1 Chrome Sets—they are factory lapped for quick, positive seating. Perfect Circle Corporation, Hagerstown, Indiana; The Perfect Circle Co., Ltd., Toronto, Canada.

Perfect Circle

The Standard of Comparison

BIG ROLE in product design



Simplifying product design is a job in which New Departure Ball-Bearings excel. N-D-Seal Bearings, for example, often require less housing space and eliminate various fittings and parts . . . make possible smooth streamlining of products and lower production costs.

Productwise, New Departures assure greater accuracy and longer life . . . permit higher speeds and reduce maintenance . . . resisting *all* loads from *all* directions.

The Great Ball of New Departure symbolizes engineering excellence—and New Departure's application engineers and research facilities are always at your disposal. Keep your eye on the BALL to be sure of your BEARINGS!

NOTHING ROLLS LIKE A BALL

NEW DEPARTURE

BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

Aeroquip

REG. TRADE MARK

BRANCHING OUT!

The seed was planted only 12 years ago but the idea grew and grew. Now Aeroquip products serve dozens of major industries with a multitude of applications.

Originally, Aeroquip produced Flexible Hose Lines and Self-Sealing Couplings for military aircraft only. Successive developments, which actually set the pace for military standards, led to Aeroquip's present position of dominance in the fields of commercial as well as military aircraft.

The development of allied industrial products presented vast new opportunities. The "Aeroquip Idea"—bulk hose that can be cut to length and detachable, reusable fittings which can be easily assembled by hand—flourished among manufacturers and users of all types of industrial equipment. Even the farmer is counted among Aeroquip's customers.

Today, Aeroquip produces and sells more hose lines for industrial and aircraft applications than any other manufacturer.

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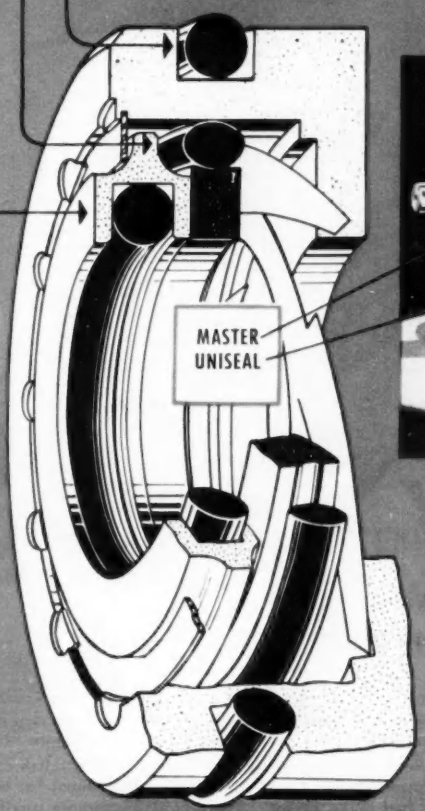
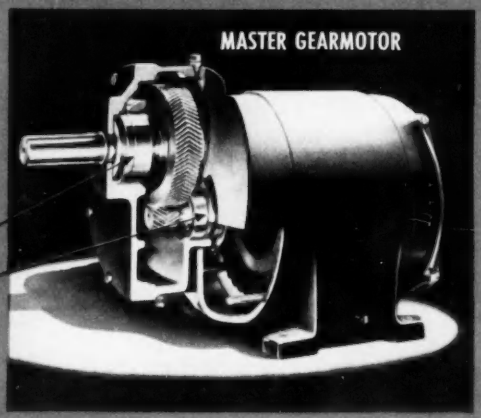
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

SAE JOURNAL, NOVEMBER, 1952, Vol. 60, No. 11. Published monthly by the Society of Automotive Engineers, Inc. Publication office at 10 McGovern Ave., Lancaster, Pa. Editorial and advertising department at the headquarters of the Society, 29 West 39th Street, New York 18, N. Y. $1 per number; $10 per year; foreign $12 per year; to members 50 cents per number, $5 per year. Entered as second class matter, September 15, 1948, at the Post Office at Lancaster, Pa., under the act of August 24, 1912. Acceptance for mailing at special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph (d-2), Sec. 34.40, P. L. and R., of 1948. Additional entry at New York, N. Y.

3 PRP "O" RINGS seal the UNISEAL

for leak-proof service!





The Master Electric Company's Uniseal—result of 25 years development—employs 3 PRP "O" Rings for simple design and leak-proof, long life performance. Ingenuous use of PRP "O" Rings in this modern design produces a free-running, unstrained rotating shaft for Master Gearmotors, where oil leakage must be prevented.

Everyone's finding it's PRP "O" Rings for top quality, long life and economy. Write or phone for your free copy of our Handbook of "O" Ring design information.

The name "*Precision*" on "O" Rings is like "*Sterling*" on silver.

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ROCK-STEADY FORTRESS *on wings!*

New AiResearch Electronic Computer keeps rocket fire "on target" with magical precision

A tiny Elevation Computer in the nose of the F-94 Lockheed *Starfire* makes this new jet in effect a rock-steady platform at the instant its rocket guns are fired.

It was developed by AiResearch as a vital part of the complete Hughes Electronic Fire Control System, which directs the F-94 to the target. The computer continually and automatically calculates the angle of attack by correcting for a half-dozen or more variable aim-influencing factors. They include the burning of fuel, disposal of ammunition, shifting of weight when rockets are fired, dropping of wing fuel tanks, rocket jump, and swift acceleration of the plane itself.

The Elevation Computer is just one of the many types of airborne electronic controls pioneered and manufactured by AiResearch. Today the company produces over 800 electronic units every month.

If you have a problem involving electronic equipment for temperature control, remote positioning, synchronizing, or analogue computers, consult AiResearch now.

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Qualified engineers, scientists and skilled craftsmen are needed now at AiResearch.

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Again...

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IN STEERING THE 1952 BUS TRANSPORTATION MAINTENANCE AWARD WINNERS

14 of 17 makes of equipment operated by the 1952 award winners use *Ross Steering*.

Again . . . convincing evidence of the *dependability* and *economy* which the exclusive *cam and lever* principle contributes to modern steering.

Whatever the steering job may be—buses, trucks, passenger cars, boats, tractors, shovels, cranes, graders, etc.—*Ross* assures *ease*, *safety* and *economy*.

We invite discussion of *any* steering problem.

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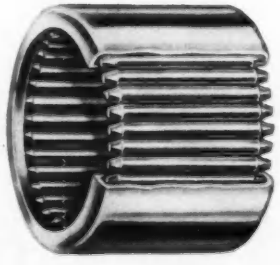
light weight carries the load

Torrington Needle Bearings are light in weight, compact. They effect weight and space savings in housings and other related parts—*without* sacrificing strength or efficiency.

The reason is simple: Needle Bearings have greater rated radial load capacity in relation to size than any other type of anti-friction bearings.

So if your design needs a bearing light in weight to handle heavy loads, investigate the advantages of Torrington Needle Bearings. Our engineers will welcome the opportunity to assist you.



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This set of service piston rings was designed not just for *any* engine—but for one particular engine only!

Thus, like the original rings, these service rings and their engine have been truly "made for each other" and will insure the maximum of power and economy.

Rings like these are the end result of close collaboration between the car manufacturer and Muskegon Piston Ring Company, whose facilities encompass every service from engineering counsel to complete packaging.

These *Factory Approved* and *Factory Engineered* Service Piston Ring Sets are available only through car dealers and other authorized service outlets.

Engine maker and Muskegon engineered this set of service rings for a single, specific engine.*

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Piston Rings
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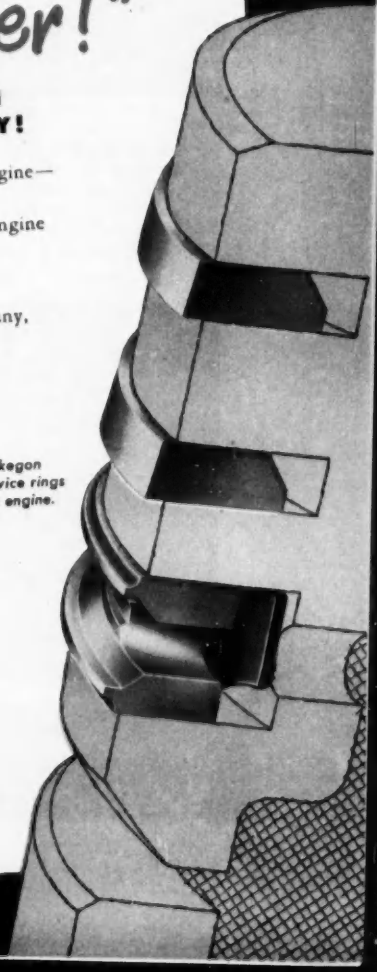
"THE ENGINE BUILDERS' SOURCE"



*Name on request

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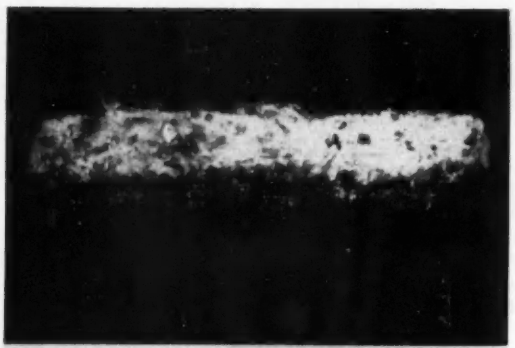
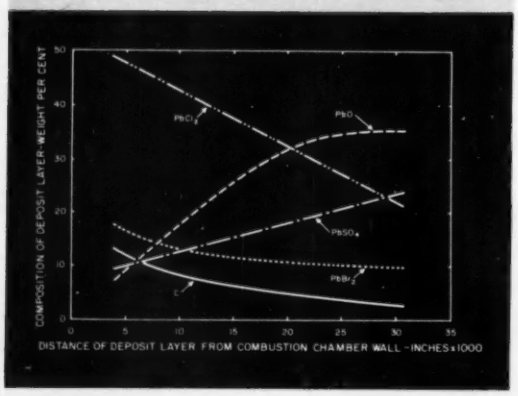
New information developed at the

Du Pont Petroleum Laboratory

reveals the sequence of chemical reactions which occur in engine deposit formation



DEPOSIT STRUCTURE CHANGES with deposit growth, as shown in the deposit cross-section above, from a mixture of black carbonaceous material and low melting lead salts at the cool chamber surface to cream colored, high melting lead salts of the hot deposit surface. This change in structure is confirmed by the chemical composition of deposit layers shown below.



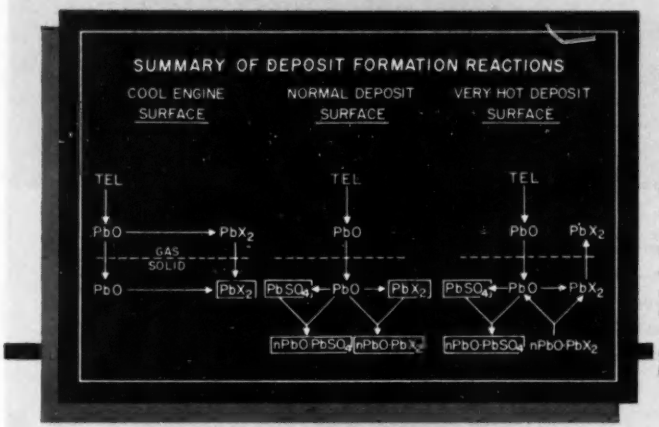
AUTOMOTIVE and petroleum engineers have long known that the formation of deposits on combustion chamber walls increases the tendency of fuels to knock. But very little was known about the reaction mechanisms which result in the accumulation of these deposits—especially with fuels containing tetraethyl lead.

Practically all modern automotive fuels contain a tetraethyl lead antiknock compound. Although almost all of the tetraethyl lead decomposition products are removed from the combustion chamber with the exhaust gases, a small amount remains on the chamber walls in the form of inorganic lead salts. Engine deposits also contain a certain amount of carbonaceous materials from incomplete combustion and both metallic and nonmetallic compounds introduced with the air, fuel or oil, and from engine wear.

THESE DU PONT STUDIES—part of a continuing series of systematic investigations on the mechanisms causing combustion chamber deposits—were limited to the reactions leading to the formation of the lead salt portion of the deposits.

The wide variety of lead salts in deposits are formed as a result of chemical reactions which occur in the combustion chamber after

DU PONT SUPPLIES A COMPLETE LINE OF GASOLINE ADDITIVES
Tetraethyl Lead Compounds (Motor Mix—Aviation Mix) • Antioxidants • Metal Deactivator • Dyes



WHEN THE WALLS are clean and relatively cool (ca. 200°C.), the reactions result in lead halide deposit formation. After deposit growth has produced an insulating layer, the surfaces are hotter and a variety of higher melting compounds are formed. When areas of the combustion chamber such as the exhaust valve become very hot, the deposit composition changes so that only very high melting compounds are formed.

the fuel-air charge is burned. And the stages in which reactions may influence deposit formation are:

1. Combustion.
2. Vapor state reactions following combustion.
3. Condensation of lead compounds on chamber wall.
4. Gas-solid reactions between lead salts and chamber gases.
5. Solid state reactions between lead salts in deposit.
6. Vaporization of lead salts.

AFTER STUDYING EACH of these stages in the reaction sequence shown, the Petroleum Laboratory arrived at the following conclusions:

The course of the reactions is dependent on the temperature of the combustion chamber walls. The compounds found in the deposit and the reactions by which they are produced under each of the temperature conditions studied are shown in the chart above.

Gaseous lead oxide, produced from the decomposition of tetraethyl lead, does not undergo vapor state reactions except when the gas layer near a clean combustion chamber surface is cool. Under these special and transitory conditions it may be converted by hydrogen halides to gaseous lead halides.

Solid lead oxide which condenses has a short life as a deposit constituent. It is attacked by acid gases to form simple lead salts or reacts with the simple lead salts in solid state reactions to form complex lead oxysalts.

The above studies will help chart the course of developments aimed at preventing, or at least reducing, deposit formation. This work on deposits is part of a continuing research program at the Du Pont Petroleum Laboratory. Since Du Pont is a major supplier of tetraethyl lead and other gasoline additives, the aim of this program is to help refiners improve fuel performance through the use of additives.

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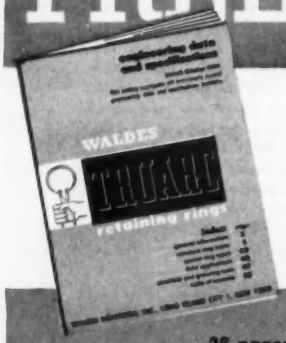
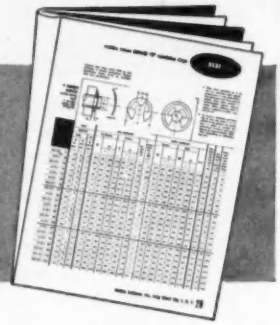
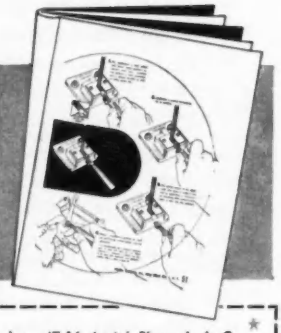


This encyclopedia of retaining rings combines—*in one 52 page volume*—engineering specifications and data for 17 different ring types—more than 600 different sizes. Gives assembly data, typical applications, everything you need to know about selection and use of Waldes Truarc Retaining Rings.



28 pages of charts giving complete engineering data and specifications. Dimensions of Rings, Grooves, Shafts, and Housings; Clearances; Allowable Thrust Loads; Safety RPM Limits. Data on end-play take-up. Countless other engineering data, arranged in easy-to-read, easy-to-use table form.

6 pages showing typical cost-cutting applications and case histories, covering self-locking rings; basic type rings; rings for taking up end-play; rings for radial assembly; and special rings.



5 pages showing drawings of assembly and accessory tools, designed to handle Truarc retaining rings on a speedy, production line basis. There are data on tools for recessing grooves, pliers and applicators for assembly, and the new Truarc "E"-ring dispenser. **You will find the new Waldes Truarc Retaining Ring Catalog** *invaluable* in selecting and specifying Truarc retaining rings, the better way to hold parts together.

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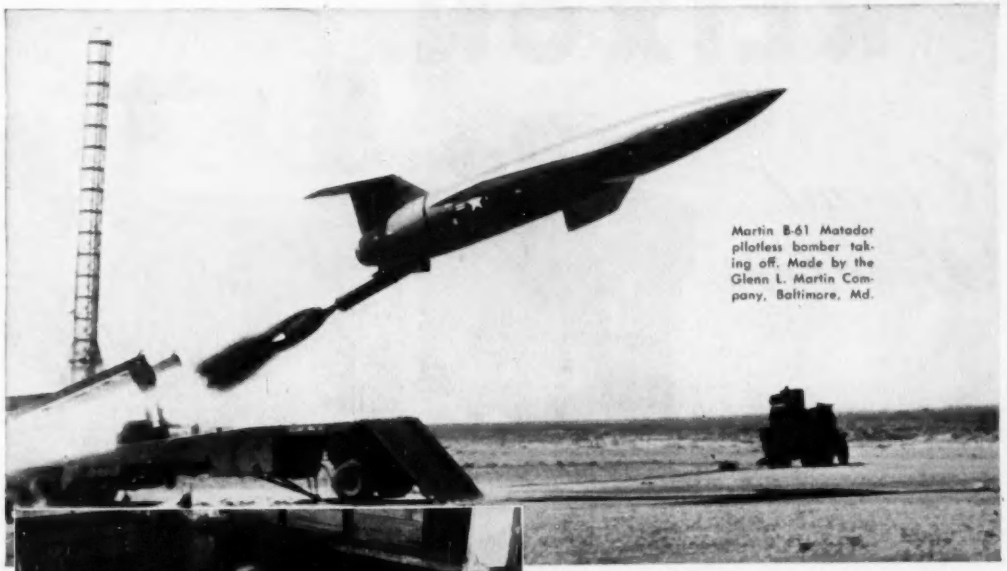
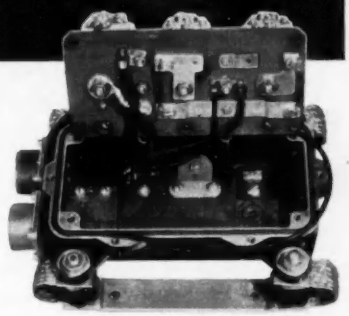


Martin B-61 Matador pilotless bomber taking off. Made by the Glenn L. Martin Company, Baltimore, Md.

Jeep almost completely submerged. Can be operated in this position at about 9 miles per hour. Made by Willys-Overland Motors, Inc., Toledo, Ohio, for the Armed Forces.

In the Air— On Land— Under Water—



Generator regulator for the 24-volt system of the submersible Jeep. This is completely waterproof and highly resistant to corrosion and fungi. Produced by The Electric Auto-Lite Company, Toledo, Ohio.

Illustrated are two of the many types of capacitors and filters made by Aerovox Corporation, New Bedford, Mass.; an important capacitor supplier to both Electric Auto-Lite and Glenn L. Martin. The unit above is the filter capacitor used in the generator regulator of the submersible jeep while the unit at the right is used in the pilotless bomber.

WHERE REQUIREMENTS ARE SEVERE, CALL REVERE

The dramatic pictures on this page show two important special applications of Aerovox capacitors. One is the Martin B-61 Matador pilotless bomber. It contains an Aerovox capacitor, which has to withstand the terrific acceleration and speed of the craft. The other is the submersible Jeep. Its 24-volt electrical system is completely waterproofed, and includes Aerovox filters and capacitors for suppression of radio interference. Revere not only supplied copper and brass strip for the capacitor cases, but collaborated closely in setting up specifications, and in addition worked on a welding problem. In regard to the latter, an Aerovox Project Engineer wrote: "We have had much better welds." . . . Revere is always glad to collaborate on problems concerning copper and its alloys, aluminum alloys, and electric welded steel tube. Call the nearest Revere Sales Office.

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KLIXON

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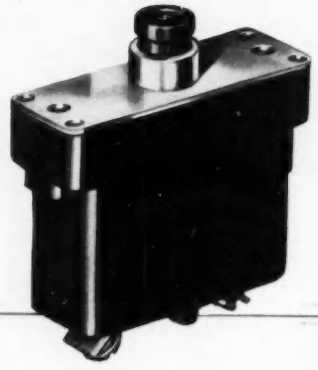
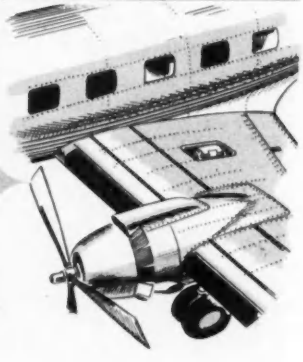
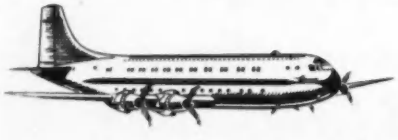


AND

Motor Protectors





KEEP PLANES *Flying*
WITH DEPENDABLE PROTECTION

From wing tip to wing tip, nose to tail, Klixon Circuit Breakers and Motor Protectors safeguard every electric circuit and actuating motor.

Klixon Circuit Breakers stand constant guard, ready to trip out the circuit instantly should action or internal trouble jeopardize the electrical system. As soon as the trouble is remedied, the pilot re-establishes the circuit by pushing a button or snapping a switch. When the automatic reset type is used, the circuit is re-established automatically.

Klixon Protectors prevent the electric motors from becoming fire hazards. Installed into the motor by the motor manufacturer, these foolproof devices safeguard motors from overheating due to stalled rotor or overloads — yet permit *maximum* operating capacity.

Should a motor become dangerously overheated the protector cuts the power "off". When it cools sufficiently it snaps the power "on" automatically restoring motor service.

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For the Sake of Argument

The Egg from the Chicken?

By Norman G. Shidle

A man makes his job as often as the job makes the man. Even in these days of job analysis and aptitude tests, "fitting the man to the job" happens no oftener than its reverse.

A man with initiative is likely to find ways to act on any job he tackles. He won't take time to find out that the job analysis doesn't require "initiative" . . . and after a while, when somebody gets to rewriting the job description it's ten to one "initiative" will be made a requirement. He will have "made the job to fit the man."

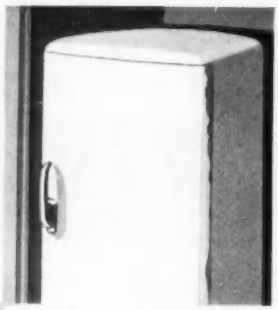
Almost everybody can recall at least one advertising manager's job which was little more than liaison between management and agency . . . Then a new man came in—and soon was actually setting the policies and carrying them out. Nor is it hard to recall cases where No. 2 exited and No. 3 went back to being a go-between. What really was happening was that the men were making the job.

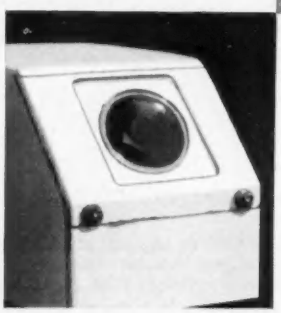
The same thing keeps happening with chief engineers and research men and designers . . . and with editors. For good or for ill, a man does make his job—more than most realize. To some, this is an opportunity. To some, it's a challenge. To some—particularly to the security-minded—it is an unfortunate necessity.

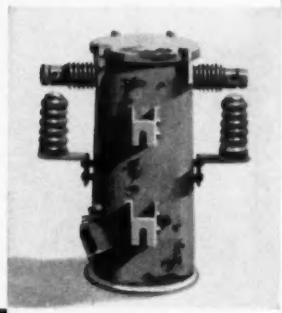
True, anyone will do best in a job which gives him a chance to exercise regularly those qualities which come natural to him. But too often we regard a job as a fixed entity; feel there is but one way to do it successfully. Yet we are surrounded by examples of dissimilar men making good in similar jobs. There may be only one best way to fill a particular job, but it is clear there are many satisfactory ways.

A man can, of course, find himself a square peg in a round hole. He can be trying to do something for which he is ill-fitted. He may utterly lack qualities absolutely essential for a given job. If he is congenitally inaccurate, he is foolish to keep trying to record and compile research test results.

But few jobs outside a production line prohibit the use of any quality we may have. Most jobs are subject to some remolding, if not remaking, by our doing well the sort of thing we can do well. The trouble isn't with the job as often as most of us like to think. "Success," someone said recently, "is still operated on the self-service plan."







PAINT FAILURE *can wreck your product's reputation!*

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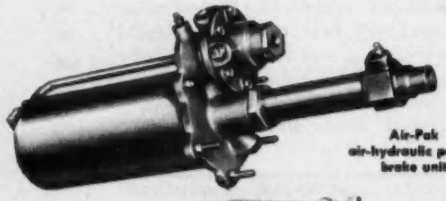

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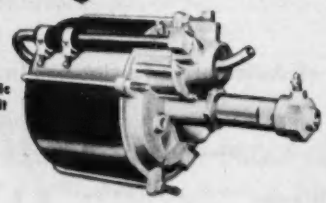

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NACA's Rockets Gather Data for Missile Design

Joseph A. Shortal,
Chief, Pilotless Aircraft Research Division, National Advisory Committee for Aeronautics

Based on paper "NACA's Role in Guided Missile Research" presented at SAE Annual Meeting, Detroit, Jan. 17, 1952.

NACA is getting aerodynamic data for guided-missile design from rocket-propelled models in free flight.

Their method is to rocket-propel a model to some supersonic speed, then take data from the time the rocket stops thrusting until the model slows down below sonic speed. The rocket is simply a means of attaining the desired speed.

Investigators have used the method to gather data on such problems as

- Effects of body shape, wing shape, external stores, and skin friction on drag;
- Hinge moments and effectiveness of control surfaces and of vanes operating in the rocket jet;
- Longitudinal stability and damping in roll;
- Automatic stabilization;
- Aerodynamic fundamentals such as buffeting and flutter.

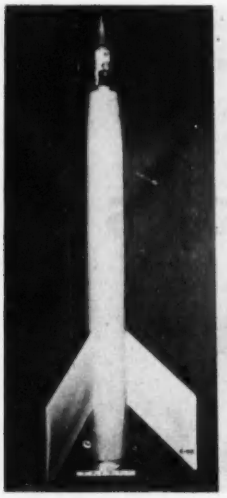
The method is useful for controls studies because airflow over a body moving at supersonic speeds stabilizes very rapidly. Following a change in attitude, supersonic airflow over a wing stabilizes during two chord-lengths or so of wing travel. Since a wing of 1.5-ft chord moving 1500 fps traverses 1000 chord lengths per sec, a considerable amount of data can be accumulated in a few seconds of free model flight.

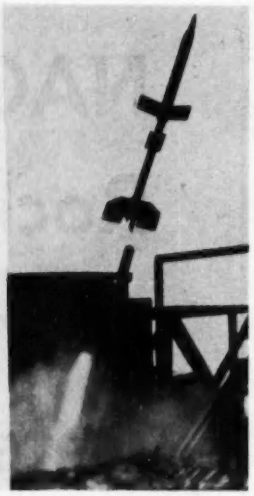
Special advantage of the method is that these models of relatively large characteristic length traveling at high speeds provide data at higher Reynolds numbers than can be obtained from most high-speed wind tunnels.

NACA's Pilotless Aircraft Research Station at Wallops Island, Va.—where these photographs were taken—is conducting the rocket-model research program.

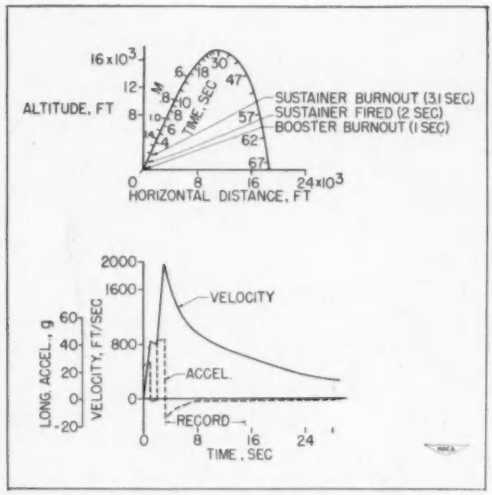
(Paper on which this abridgment is based is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members, 50¢ to nonmembers.)

Turn page for pictures of models and instrumentation used by NACA



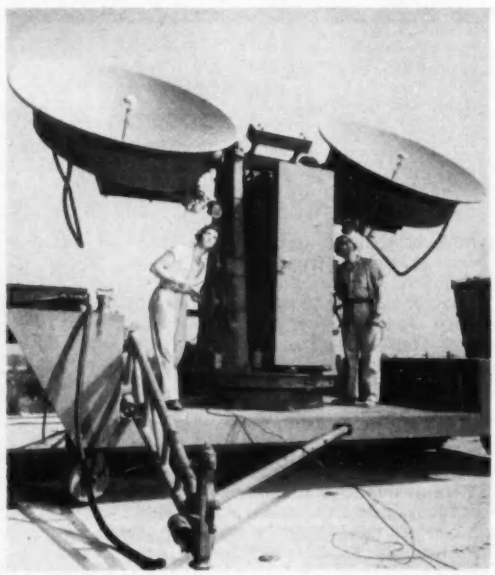


1. Typical model built to study zero-lift drag and control effectiveness is a light hollow wooden structure 5 in. in diameter and 5 ft long. Inside the model is a standard aircraft rocket, and a booster rocket is attached at the tail. Model and booster are launched at an angle of about 70 deg.

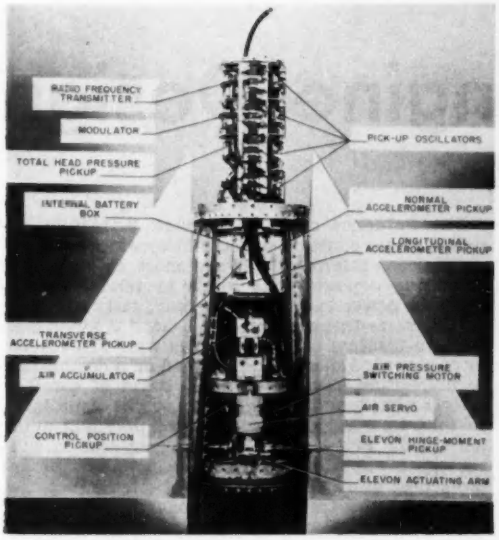


2. Plot of flight shows that booster burns for 1 sec, accelerating the 40-lb model-booster combination to a Mach number of 1.4. Then booster separates from model. Internal rocket fires 1 sec later and accelerates the model to Mach 1.8. Useful data are obtained for about the next 10 sec.

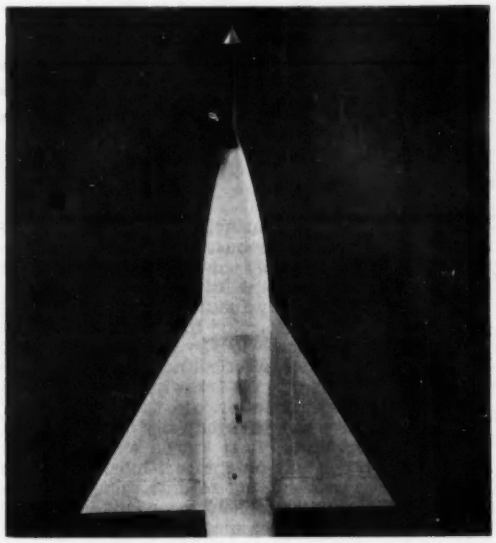
3. Space radar tracks model and furnishes information for calculating trajectory. Altitude information together with atmospheric data obtained with radiosonde balloon discloses pressure and temperature along flight path. Trajectory and speed depend on choice of internal and booster rockets.



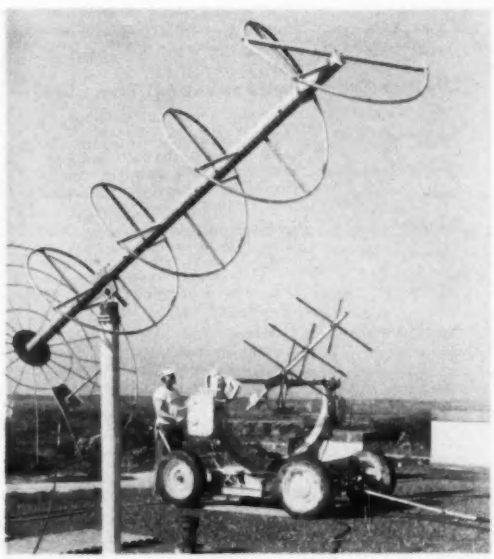
4. Velocity radar operating on the Doppler principle provides precise measurements of the velocity at any instant. Accelerations are found by differentiating velocity with respect to time. The ground radar units provide quite accurate measurements of the drag of the model.



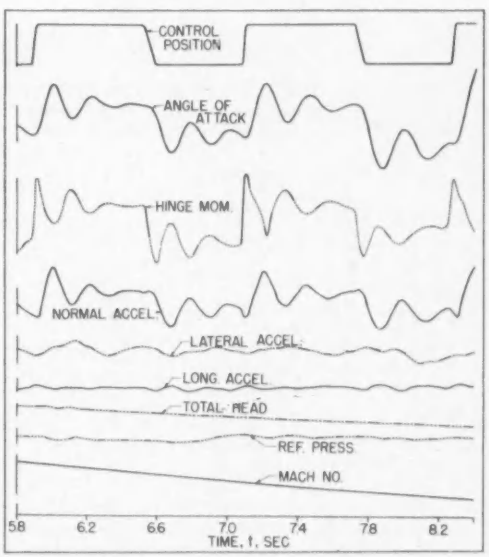
5. Telemeter units installed inside some models furnish additional information directly to recorders on the ground. Accelerometers and other pickups are shown mounted in this model, which was built for studies of longitudinal stability and control under lifting conditions.



6. Telemetering model contains so much instrumentation that there is no room for an internal rocket. Booster rocket alone powers model. Internal instrumentation moves elevators alternately between stops. Dwell period is ½ sec at each extreme. Attitude varies in response to elevators.



7. Antenna picks up signals telemetered from model. Analysis of data from oscillating-pitch model reveals stability information, location of aerodynamic center, variation of lift with angle of attack, control effectiveness, variations of hinge moment, and drag for various lift coefficients.



8. Plots of data telemetered from model show very rapid response to elevator motion. Model executed about three cycles in pitch, then trimmed at a steady value for each control position. This oscillation is shown in the angle of attack, hinge moment, and normal acceleration records.

Changes in Engine Design

OF all the factors influencing the magnitude of power loss due to combustion-chamber deposits, engine design is probably the most important from the practical standpoint of minimizing deposit effects with present-day fuels and lubricants. Operating conditions determine to a large extent the amount of deposit power loss in a given engine, but it is generally neither practical nor possible to control fully these conditions. Likewise, while fuel and oil composition affect power loss, there is probably little difference among the majority of commercial fuels and lubricants. It is known that extensive research is under way on the fuel-lubricant phase of the deposit problem, but to date there is no indication of a commercial solution. This leaves engine design as a possible means of minimizing the deposit power loss problem where it does exist. Fortunately, there is ample evidence that certain combustion-chamber designs are far superior to others, and that the superior designs will be favorably affected by any future improvements in fuels and lubricants that may minimize deposit effects.

The influence of engine design is readily observed under constant-speed and constant-load operating conditions, which are most conducive to producing deposits that result in relatively high levels of power loss. In one study, tests were run on two valve-in-head and two L-head engines used in farm tractors. These engines were run for 100 hr at governed speed and 75% load on a commercial regular-grade gasoline (a 50–50 blend of catalytically cracked and straight-run stocks containing 1.5 ml tel per gal and a widely used premium-grade motor oil. Fig. 1 shows the per cent loss in full-throttle brake horsepower, and deposit weight expressed as gram per cubic inch of engine displacement. Of the three engines, AC, AE, and AF of approximately 30 cu in. displacement per cylinder, engine AF (a valve-in-head design) showed only 4% loss in power, although it formed slightly more deposit than valve-in-head engine AC, which suffered a 10% power loss. The marked effect of combustion-chamber configuration with a given valve arrangement on deposit power loss is shown by this

IMPORTANT factors, according to the authors, that must be considered in a study of engine power loss caused by combustion-chamber deposits are:

- Fuel composition.
- Lubricant composition.
- Tel concentration.
- Operating conditions.
- Engine design.

After studying the effects of all these variables, the authors have concluded that power loss can be reduced most through changes in engine design.

Presented here is the section of their paper that covers this subject, namely, engine design.

Their complete paper, which will be published in the October issue of SAE Quarterly Transactions, also gives data concerning the other variables mentioned above.

At the right is a table that summarizes their findings with regard to all five factors.

Effect of Five Variables on Deposit Power Loss

Variable	Effect on Deposit Power Loss
Fuel composition	Differences in effect among the majority of commercial fuels and lubricants are small, although relatively large differences may exist in certain critical engine applications
Lubricant composition	
Tel concentration	Lead concentration is not an important factor in passenger-car and truck operation, although under constant-speed and constant-load conditions deposit power loss is directly related to tel concentration.
Operating conditions	Conditions under which deposits accumulate are a major factor in deposit power loss, but it is seldom practical to control them (constant-speed, constant-load operation is the worst condition)
Engine design	SO Engine design becomes the principal means of alleviating the problem

Design Features that Minimize Power Loss:

1. Introduction of intake charge to engine cylinder with minimum contact with deposit-coated surfaces.
2. Low ratio of combustion-chamber surface area to engine displacement.
3. Adequate open areas adjacent to intake valve so that deposit buildup will not cause physical restriction to flow of incoming charge.

Can Reduce Power Loss

H. J. Gibson, C. A. Hall, and A. E. Huffman, Ethyl Corp.

Excerpts from paper, "Combustion-Chamber Deposition and Power Loss," presented at the SAE Annual Meeting, Detroit, Jan. 17, 1952. This paper was published in full in the October, 1952, SAE Quarterly Transactions.

comparison. Engines AE (L-head) and AC had power losses of 12 and 10%, respectively, with widely different deposit weights, while the smaller L-head engine AB was more sensitive to deposits, showing a 14% power loss.

Similar constant-speed and constant-load dynamometer tests were conducted on three makes of passenger-car engines, the results being presented in Fig. 2. L-head engine C gave 10% power loss with 0.3 g of deposit per cu in. of displacement. In comparison, valve-in-head engine D gave only 3% power loss with one-third more deposit weight; and valve-in-head engine F-3 gave 5% power loss with approximately the same unit deposit weight as engine C. These data, along with those presented in Fig. 1, illustrate the effect of different engine designs on deposit power loss, and show that there is no direct correlation between power loss and deposit weight per cubic inch of engine displacement.

The effects of engine design are also readily observed in other types of operation, such as passenger-car service, as shown in Fig. 3. The data are based on the average loss in acceleration from 10 to 30 and from 10 to 50 mph due to deposits. Each bar represents an average value for a number of vehicles of that particular make. The same lubricant and fuel containing 3.0 ml tel were used in all vehicles. L-head engines C and A gave 2.5 and 2.2 times as much loss in acceleration, respectively, as valve-in-head engine D.

It is apparent from the foregoing that differences in deposit power loss due to engine design exist in a wide variety of types of engine operation. This is emphasized by the data in Table 1, which show that L-head engine C had 2.5 to 3.7 times as much power loss as valve-in-head engine D in three widely different types of service. It is evident that engine design is an important factor in the deposit power loss proolem and that engines in operation at the present time differ as much as three-fold in this regard.

The authors' data, as well as that of others, show that two-thirds of the power loss caused by deposits is due to reduction in airflow and that the reduction is caused by physical and thermal restrictions. Examples of physical restriction caused by deposit buildup have been prevalent in the past with some small single-cylinder engines. Investigation of excessive deposit power loss in one of these small engines revealed that intake valve lift was so small that deposits on the block around the valve caused physical restriction by reducing the effective valve opening. The restriction was of such magnitude

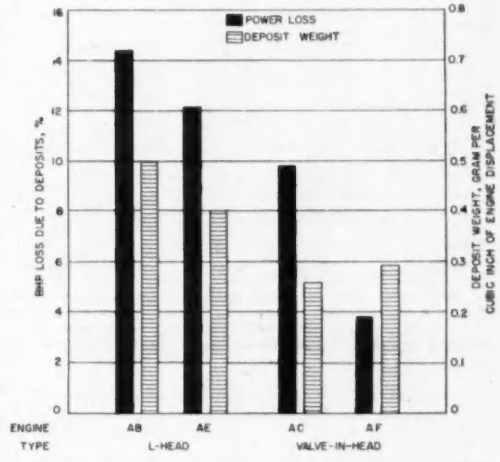


Fig. 1—Effect of design on deposit power loss in tractor engines. Fuel: commercial regular-grade gasoline 2-C, 1.5 ml tel, 0.20% S. Oil: premium grade 2-A. Operating conditions: 100 hr at governed speed, 75% load

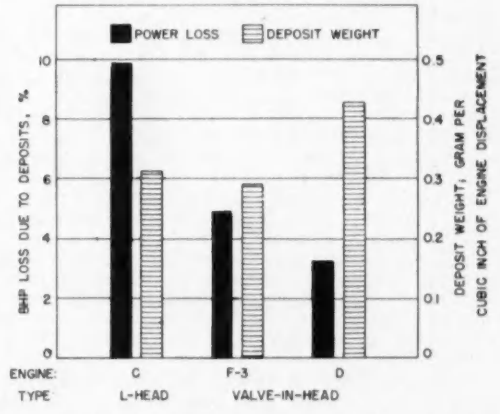


Fig. 2—Effect of design on deposit power loss in passenger-car engines. Fuel: catalytically cracked and straight-run blend 11-A, 3 ml tel, 0.05% S. Oil: MIL-0-2104, extracted Midcontinent base, 1-B. Operating conditions: 100 hr at 3000 rpm, 75% load

Table 1—Comparison of Two Engine Designs in Several Types of Service

Service	Engine D (Valve in head)			Engine C (L head)		
	No. of Tests	%	Relative Deposit Power Loss	No. of Tests	%	Relative Deposit Power Loss
Dynamometer, constant speed and load	5	3.1	100	5	8.7	280
Passenger-car service	7	2.4	100	6	6.0	250
Heavy-duty truck operation	12	0.7	100	18	2.6	370

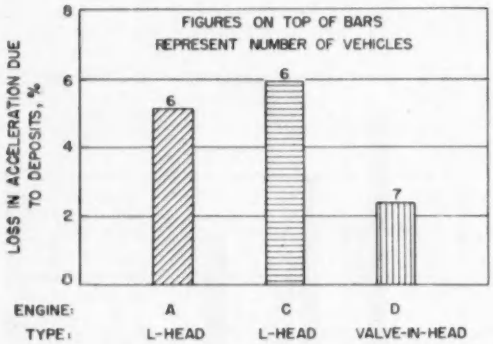


Fig. 3—Effect of design on loss in acceleration caused by deposits in engines in passenger-car service. Fuel: 100% catalytically cracked 3-A, 3 ml tel, 0.04% S. Oil: 100% Pennsylvania, regular grade, 24-A. Operating conditions: 12,500 miles of normal city and country driving

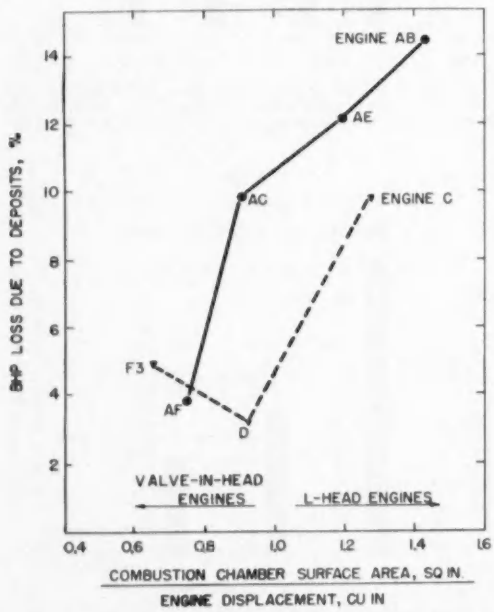


Fig. 4—Effect of ratio of combustion-chamber surface area to engine displacement on deposit power loss. Connected points represent tests with same fuel and oil under similar constant-speed and constant-load conditions

that the engine could not produce rated power output after 150 hr of operation. This condition was remedied by increasing the valve lift from 1/8 in. to 3/16 in. with the result that power loss was insignificant even after 1000 hr of operation.

In most automotive engines physical restriction appears to be negligible. To prevent this type of restriction from becoming a problem, however, care should be exercised in the design of compact combustion chambers having large intake valves. Adequate clearance between the wall and the intake valve must be provided so that normal deposit buildup in this area will not restrict the flow of intake charge.

Thermal restriction of intake charge caused by deposits occurs in varying degrees in all engines. Deposits cause this type of restriction by transferring heat, absorbed during the combustion and exhaust portions of the engine cycle, to the incoming charge and thereby reduce the weight of charge entering the cylinder. For this reason, it would appear that the amount of combustion-chamber surface area to which deposits could adhere might be an important factor in the deposit power loss problem. To be more specific, if we assume that surface area is an indication of the amount of deposition to be expected and engine displacement is an indication of the amount of intake charge, a general relationship might exist between power loss and the ratio of surface area to displacement. Since the surface-to-displacement ratio is minimized by making a more compact combustion chamber, and also by increasing the displacement per cylinder, it might be expected that those engines with a minimum value for this ratio would suffer minimum power loss. Fig. 4 shows such a general relationship for some of the engines used in our tests. The power loss in per cent is plotted against the ratio of surface area in square inches to displacement in cubic inches. The points connected by straight lines represent test results obtained on different engines with the same fuel and lubricant and similar operating conditions. There is a general trend of increasing deposit power loss as the ratio of surface area to engine displacement is increased. The L-head engines, as compared with valve-in-head engines, have a higher surface-to-displacement ratio and, as previously noted, usually suffer more power loss.

Although this general relationship of surface-to-displacement ratio and power loss exists, it should be pointed out that this is not the only factor involved. For instance, engines AF and AC are both valve in head, of very nearly the same surface-to-displacement ratio, and yet engine AC had 2.5 times as much power loss as engine AF. Furthermore,

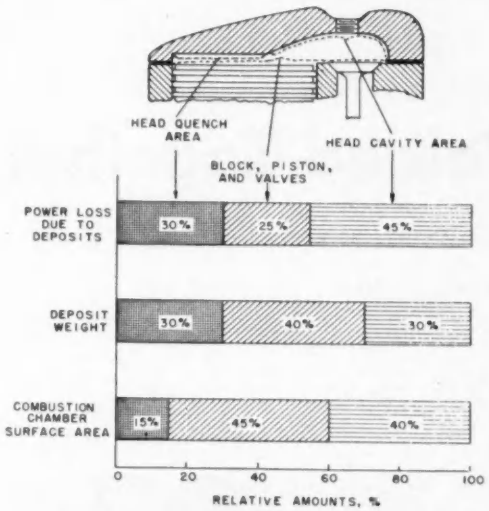
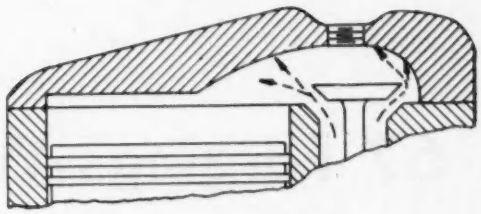
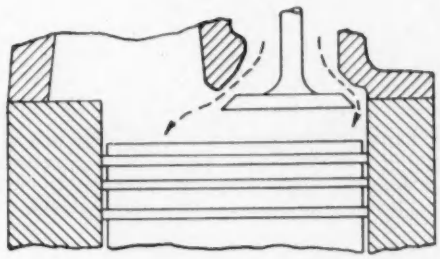


Fig. 5—Effect of deposit location on power loss. Engine C, average results from 9 tests



"POOR" DESIGN – HIGH POWER LOSS

Intake valve position causes incoming charge to scrub relatively large areas of deposit-coated surfaces. Surface-displacement ratio is high.



"GOOD" DESIGN – LOW POWER LOSS

Intake valve position causes incoming charge to flow directly into the cylinder. Although the surface-displacement ratio of this design is high, a considerable portion of the deposit-coated surface is located so as to have minimum contact with incoming charge.

Fig. 6—Features of poor and good design from standpoint of deposit power loss

engine F3 has a somewhat lower ratio than engine D and yet shows somewhat greater power loss. Obviously, there are other factors involved. One of the most important of these is the relative location of deposits with respect to the incoming charge. An indication of this is given in Fig. 5, which presents the effect on power loss of selective removal of deposits from different portions of the combustion chamber; the results are based on nine tests in engine C. Deposits in the head cavity area, which would be most thoroughly scrubbed by the incoming charge, were the most effective per unit weight in causing power loss. These deposits, comprising only 30% of the total weight, caused 45% of the total power loss. In contrast, the block, piston, and valve deposits, comprising 40% of the total weight, caused only 25% of the power loss. In the head quench area, 30% of the total deposit caused 30% of the power loss.

The foregoing suggests that combustion chambers should be designed to minimize contact of the incoming charge with deposit-coated surfaces if power losses are to be held to a minimum. This is confirmed by analyses of test results obtained on commercial engines with different combustion-chamber configurations. Fig. 6 illustrates some features of poor and good designs. The poor design is a conventional L-head combustion chamber in which the surface-displacement ratio is high, and the position of the intake valve is such that the incoming charge scrubs large deposit-coated areas. The incoming charge is heated by this intimate contact with hot deposits and a reduction in volumetric efficiency results. In contrast is the good design, a valve-in-head type that, although having a rather high surface-displacement ratio of 0.92, has the intake valve so located that the incoming charge passes directly into the cylinder with a minimum of contact with deposit-coated surfaces. This type of design is excellent from the standpoint of power loss caused by deposits.

While the authors are not engine designers, they believe that the following factors should be given consideration in the design of combustion chambers to minimize the effects of deposits on power output.

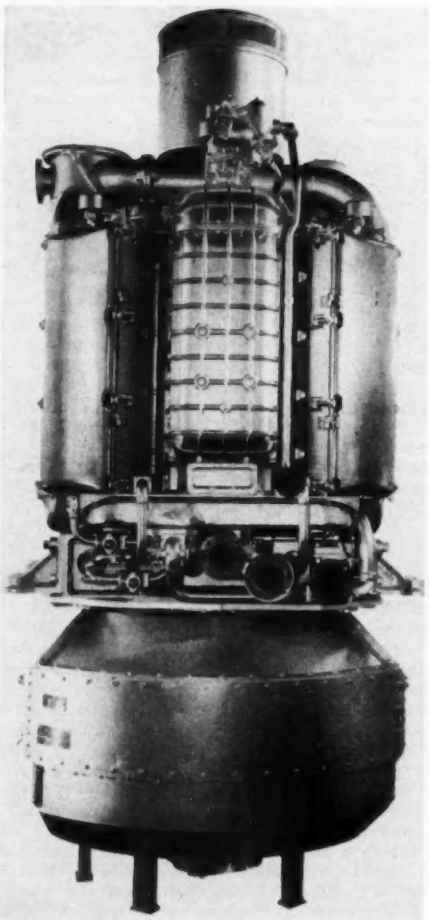
1. Provide for introduction of the intake charge with minimum contact with deposit-coated surfaces.
2. Keep the ratio of combustion-chamber surface area to engine displacement at the minimum value permitted by other design considerations.
3. Provide for adequate open areas around the intake valve so that deposit buildup will not cause physical restriction of the incoming charge.

The authors realize that many considerations enter into combustion-chamber design, but suggest that deposit power loss be given adequate attention. It would seem possible to design chambers that are good in this respect without sacrificing other desirable qualities. This is particularly important in engines designed for applications in which power loss may be a problem.

(Paper on which this abridgment is based is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members, 50¢ to nonmembers.)

67 Forgings Welded Together

THE barrel-shaped crankcase of this Cleveland Diesel Model 338 vertical radial engine is built up entirely of steel forgings which are welded together. Illustrations on the opposite page show how it's done.



The barrel section for each row of four cylinders consists of four forgings welded together. Each stress member is made up of four forgings, and each outer deck of five forgings.

Designers used photoelastic models and brittle-lacquer-coated aluminum models in preliminary design of the stress members. Then the final design was evolved with the help of stress determinations from some 50 strain gages mounted on the part. To insure accessibility and to avoid interference between parts, a wooden model of the crankcase was built up, part by part. Strain gages and wooden models were used very profitably in the design of other parts of the engine also.

The rectangular hand holes in the crankcase barrel permit easy access to the main bearings, which may be removed without disturbing the crankshaft. This is possible because the main bearing carrier consists of three sections bolted together and held in position by adjustable dowels. Retaining rings hold the slipper-type connecting rods to the crankshaft. (Although in a two-cycle engine it is generally assumed that the force on the piston is always directed toward the crankshaft, at high speeds there is a slight reversal in load which must be taken by the retaining rings.)

Bore of this two-cycle uniflow engine is 6 in. and stroke is 6½ in. The piston crown is a steel forging flash welded to the skirt under the ring belt. Stationary nozzles project a constant stream of oil through the piston trunnion to the underside of the piston. Also, up-the-rod cooling functions during about 60 deg of crank angle.

The crankshaft is drop forged alloy steel. Due to the crank arrangement, it was impossible to balance each crankthrow completely, but finished crankshafts balance perfectly, both statically and dynamically.

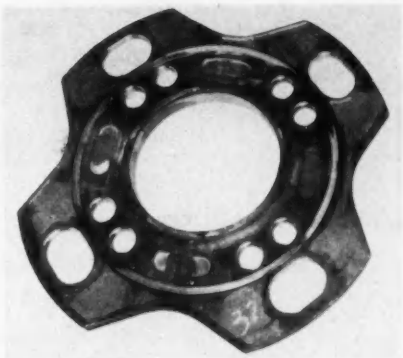
The 30 air-intake ports in each liner are covered and uncovered 49 deg before and 49 deg after bottom center. Four exhaust valves are located in the cast-iron cylinder head.

Form a Diesel Crankcase

Eric R. Brater, Assistant Chief Engineer, Cleveland Diesel Engine Division, GMC

Based on paper "Development of a 16 Cylinder, Vertical, Radial Diesel Engine" presented at SAE Summer Meeting, Atlantic City, June 5, 1952. Complete paper is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members, 50¢ to nonmembers.

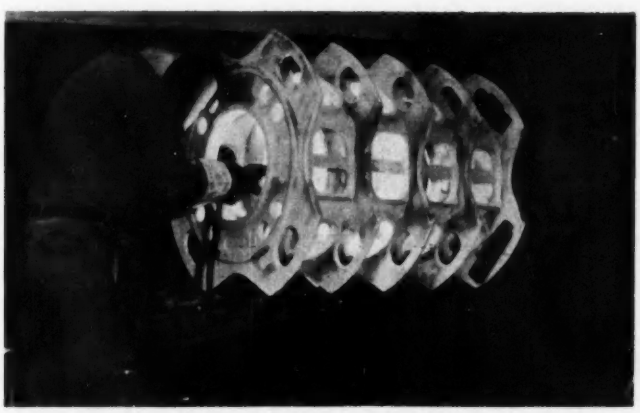
4 four-piece barrels . . .



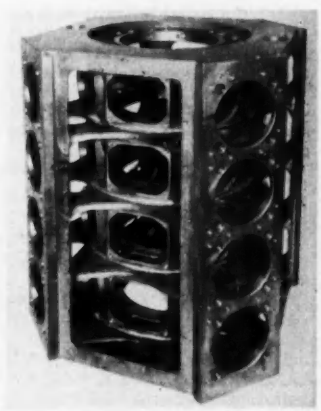
+ 5 four-piece stress members . . .

+ 4 five-piece decks

. . . + 8 blower supports + 1 top deck + 1 bottom deck + 1 bottom support ring . . .



. . . are joined by the welder to make . . .



. . . this crankcase.

The Ducted Fan Jet:

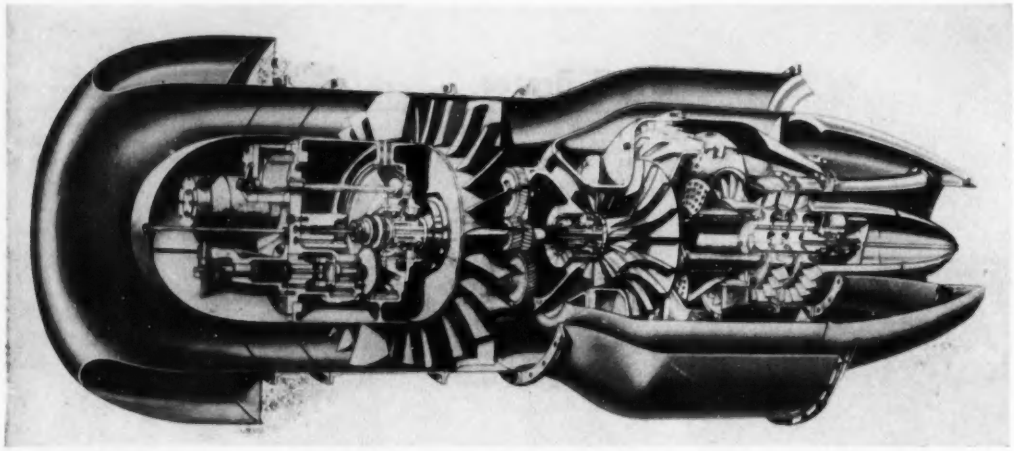


Fig. 1—Cutaway view of Aspin ducted-fan, jet-reaction turbine. Variable-angle vanes ahead of fan control thrust, giving instant action without change of turbine speed

DUCTED-fan jet engines are likely to power future light aircraft.

The ducted fan performs best in the mid-speed range—the 200 to 400 mph that most proposed light airplanes will travel. At these speeds, it has the advantage over the slow-speed propeller and the high-speed jet-reaction turbine.

The ducted-fan turbine engine is similar to a turboprop except that the shaft power goes to the fan instead of a propeller. The radial fan operates in an annulus extending the length of the engine. Part of the airflow from the fan supercharges the power section. The rest of the air emerges as a low-temperature, fairly low-velocity jet.

The Ducted-Fan Engine

One ducted fan suitable for light aircraft is already in production in France and is licensed for production by Continental in this country. This is the Aspin—a member of the Turbomeca family of small gas turbines.

These turbines feature a single-stage centrifugal compressor, a very short annular combustor, and an axial-flow turbine. Centrifugal force atomizes the fuel, which is thrown out from the rotating turbine shaft, thus eliminating multiple-spray nozzles with their high-pressure fuel systems.

The compactness of the combustor arrangement permits close coupling of the compressor and turbine, and the main bearings are safely mounted outside of these parts. This reduces vibration and bearing-cooling problems. A support connected by three links to the stationary low-temperature outer combustor housing carries the rear bearing.

In the Aspin ducted-fan engine, shown in Fig. 1, a shaft turbine is the basic power-generating unit. A multiblade low-pressure-ratio axial-flow fan absorbs the useful power. A portion of the air pumped by the fan supercharges the power section. The balance of the air is ducted aft as a low-temperature, relatively low-velocity jet. The ratio of air through this outer duct to the air through the high-pressure compressor wheel is about 7 to 1. Adjustable vanes control the airflow through the fan and the resultant jet thrust.

The Aspin I ducted fan is rated at 528 lb maximum thrust with a fuel consumption of 0.61 lb per lb thrust per hr. The Aspin II is rated at 790 lb maximum thrust with a specific fuel consumption of 0.55. Both engines weigh 304 lb.

Ducted Fan versus Turbojet and Turboprop

The ducted-fan engine delivers its available energy as a high-mass-flow, low-velocity jet, in contrast to the low-mass, high-velocity flow in the straight turbojet. The thrust per pound of fuel in the ducted-fan engine is about twice that of the turbojet under static conditions and at low air

Powerplant for Future Light Aircraft

Carl F. Bachle and Whitney Collins,

Continental Aviation and Engineering Corp.

Based on "The Case for Turbines in Small Aircraft" by Bachle presented before SAE Western Michigan Section on Jan. 23, 1952 and "Continental-Turbomeca Small Gas Turbines" by Collins presented at SAE National Aeronautic Meeting, New York, April 22, 1952.

speeds. In a performance comparison, a Turbomeca ducted fan delivered about 580 lb engine thrust with a specific fuel consumption of 0.9 lb per lb thrust per hr at 200 mph, but the Turbomeca straight turbojet gave an engine thrust of only 280 lb with a specific fuel consumption of 1.35.

For speeds under 150 to 200 mph, the ducted fan will not produce thrust as efficiently as the turboprop. But in the speed range from 200 to 400 mph, the ducted fan offers the compactness of propellerless installation, ease and rapid response of power control, and absence of propeller noise. These factors favor use of the ducted fan in this range even if the propeller engine may have better fuel economy.

Ducted Fan versus Piston Engine

The Aspin ducted-fan engine, as compared with piston engines, has the advantages and deficiencies of all the small Turbomeca gas turbines. The advantages are:

1. Extremely high power-to-weight ratio.
2. Mechanical simplicity and ease of servicing.
3. Broad fuel tolerance.
4. Freedom from vibration.
5. Ease of cold starting.
6. Absence of engine cooling system.

The disadvantages are:

1. High fuel consumption.
2. High idle-noise level.
3. Sensitivity to high air temperature.
4. Complex power control.

The controlling characteristics are generally the high ratio of power per unit weight and the high specific fuel consumption. But in the cruise range of 300 mph, the ducted fan will use less fuel than a piston engine.

Table 1 compares results of a design analysis of a ducted-fan aircraft and a current piston-engine plane.

The ducted fan is almost equivalent in performance to the piston engine except that the ducted fan has a speed 60% greater. A piston-engine aircraft with performance equal to the ducted fan would require an engine of 900 maximum hp, a supporting airframe of much greater weight, and al-

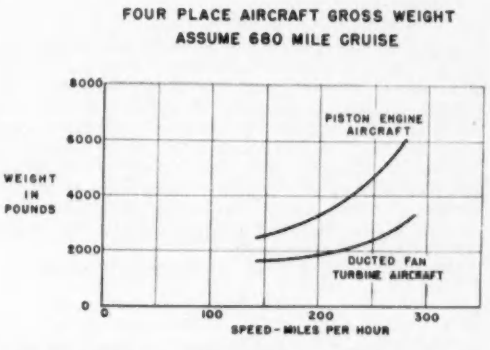


Fig. 2—Weight of piston-engine and ducted-fan aircraft versus speed

Table 1—Comparison of Piston-Engine Aircraft and Ducted-Fan Aircraft

	Present Piston Engine	Ducted Fan	Piston Engine with Ducted Fan Performance
Cruise Speed, mph	170	270	270
Cruise Range, miles	680	680	680
Miles per Gallon	18	5.8	4.2
Weight of Aircraft, lb	1625	1625	3400
Weight of Powerplant, lb	600	300	1400
Take-Off Power, hp	200	450	900
Weight of Required Fuel, lb	230	700	970
Estimated Aircraft Cost	$18,000	$22,000	$50,000

most 40% more fuel—all adding up to greater cost.

The power in ducted-fan aircraft is not subject to the large nacelle and cooling-drag losses of propeller aircraft. These losses mount rapidly as speed increases, and at 300 mph, 33% of the piston-engine power is wasted.

To compensate for these losses, the power of the piston engine must be increased, and the size and weight of the engine must also rise. Fig. 2 shows that, in one study, the ducted fan gives the same performance as the piston engine but in an aircraft weighing less than half the propeller craft.

The Ducted-Fan Aircraft

Fig. 3 illustrates a projected four-place ducted-fan aircraft. Features of this plane will probably include

1. Pressurized cabin to permit flight at 20,000 ft.
2. Wing-root engine-air intake.
3. Wing-tip fuel tanks.
4. Flush rivets on large section of wing and fuselage.
5. Extra-large flaps.
6. Jet-fighter streamlining.

Flight in the ducted-fan aircraft would be free from engine noise and vibration. The possibility of increased over-the-weather flying will result in greater passenger comfort. For cabin pressurization, air at the required pressure can easily be bled from the turbine. The cabin is readily accessible because of the low cabin door ahead of the wing, and the absence of a propeller makes for excellent visibility. Fuel carried far from passengers and powerplant and the rear mounting of the engine are additional safety features.

(Papers on which this abridgment is based are available in full in multilithographed form from the SAE Special Publications Department. Price of each paper: 25¢ to members; 50¢ to nonmembers.)

Excerpts from Discussion

G.C. Prill, CAA: Have you considered the ducted fan as a booster for a transport?

Collins: Yes, it has possibilities, but it's more expensive and has greater frontal area than the turbojet.

R. J. Woods, Bell Aircraft Corp.: I would appreciate your commenting on the augmented ducted fan.

Collins: I would like you to comment on that.

Woods: Well, at Bell we've been intrigued with the idea of making the ducted fan discharge into an afterburner. It results in a tremendous increase in the power available for take-off and climb at reasonable fuel consumption rates.

J. J. Green, Canadian Defense Research Board: Why not use axial compressors?

Collins: The centrifugal compressors are more efficient in the small sizes and cheaper. Also, centrifugal compressors deteriorate less in performance with operation.

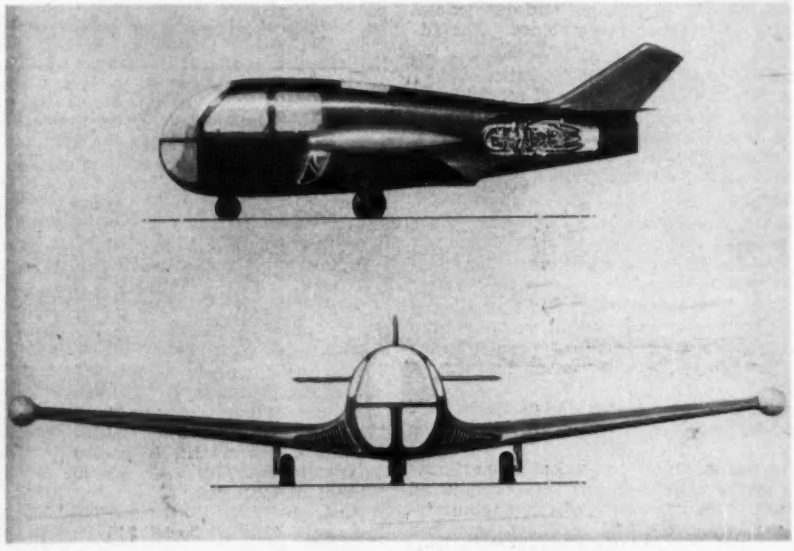


Fig. 3—Four-place single-engine ducted-fan aircraft

In Car Cooling Systems It's the Little Things that Count

Arthur W. Pope, Chief Research Engineer, Waukesha Motor Co.

Report on Round Table on Automotive and Powerplant Cooling Systems held at SAE Summer Meeting, Atlantic City, June 5, 1952, under the auspices of the SAE Passenger Car Activity. Discussion leader was F. M. Young.

TALK about troubles in vehicle cooling systems and most people think immediately of the radiator. But cooling system effectiveness goes back to a lot of other things . . . from major design decisions such as body styling and engine type to detailed engineering of the water pump and thermostat. And how the car owner maintains the cooling system can spell the difference between trouble-free and troublesome operation.

Better-functioning cooling systems will come from gains in all these areas. A crystal-ball look at the future shows no single cure-all ahead. But some changes are sure to come, others still are a long way off. Here are just a few:

• Normal operating temperature will go up 20 to 30 F to between 180 and 190 F. Boiling or "pop-off" temperatures will be limited to about 225 to 230 F. These higher temperatures will come after detonation comes under control through improved engine design and fuels, and valve cooling. Eliminating hot-spots will permit high-temperature anti-freezes to last longer too.

• Sealed systems may be more than 10 years away. Before that comes, we'll have to have: (1) a public trained to keeping its hands off the cooling system, accepting coolant replacement by authorized people with authorized materials; (2) a year-around coolant which has yet to be developed; (3) engine design changes that prevent liquid losses and air injection at the pump and keep combustion gas out of the cooling system; and (4) radiators, particularly soldered ones, that won't leak.

• Aluminum radiators can be built, but problems still remain. For example, there's a shortage of

Seated behind the table, partly hidden by the audience, are the members of the Round Table on Automotive and Powerplant Cooling Systems who took apart the cooling system to show what makes it tick. They are (left to right): Secretary A. W. Pope, Waukesha Motor Co.; J. R. Holmes, Harrison Radiator Division, GMC; D. H. Green, National Carbon Co.; H. B. Drapeau, The Dole Valve Co.; Panel Leader F. M. Young, Young Radiator Co.; Herbert Schuldt, Schwitzer-Cummins Co.; F. B. Herz, Long Mfg. Div., Borg-Warner Corp.; and F. F. Kishline, Nash Kelvinator Corp.

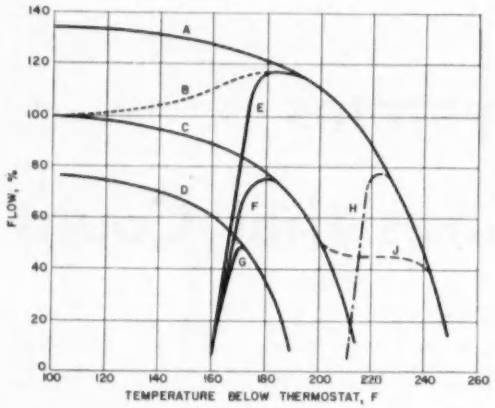


Fig. 1—These curves show the temperature-flow characteristics of the open and pressurized cooling system with and without thermostats. The curves represent the following configurations: A—12-psi pressurized system; B—12-psi cap system; C—open system (water); D—open system (50% alcohol); E—160 F "solid expansion" type thermostat; F—160 F solid expansion or vapor pressure type thermostat; G—160 F solid expansion or vapor pressure type thermostat; H—160 F vapor pressure type thermostat; and J—leaking cap

lithium flux needed for the present brazing method, and the stuff is quite expensive. It'll take at least another five years of service experience before the life of an aluminum radiator on a passenger car can be forecast.

Grilles Bring Groans

Engineers may parry on the pros and cons of aluminum radiators, but they all are positive that body styling stymies cooling efficiency. Says one engineer:

"The prolific embellishments of front end grilles employing complicated combinations of massive bars woven across the air openings in various futuristic patterns, apparently with no object in mind other than to adorn the front end with massive, shapeless, glittering objects, has become the styling vogue and the most important part of the automobile. The cooling function is left to be accomplished through some miracle by the experimental engineering divisions."

Often shape and position of grille bars affect the cooling result, even though total projected area of openings is the same. In one case, no other change than one of making horizontal grille bars vertical brought an 8 F drop in cooling.

Placing large obstructions in front of air intake areas also plays hob with the cooling system. Add to what the stylist tacks on additional accessories such as bumper bars, fog lights, and license plate frames and cooling quickly goes to pot.

We're not arguing for unattractive appearance, say vehicle engineers. They just want stylists to ply their skill toward a functional arrangement . . . not to go ahead on their own, without proper guidance, but to preserve the necessary provisions for cooling air admission.

Cooling system engineers, and particularly those who design radiators, wail an ever sadder lament. They claim they're caught in a squeeze. The styling department establishes car size and proportions. Chassis engineers position the engine. Somewhere in between the front bumper and the engine comes the fan and radiator, conforming to the available remaining space.

Then the cooling system man goes through a lot of design and experimental steps, all of which boil down to selecting the thinnest core to do the job. That's because the thinnest core usually costs the least.

Designers of other cooling system components—such as fans and water pumps—feel they too are caught in the middle.

What Is Fan Noise?

For example, they say the industry today is accenting noise reduction. Fans have come in for more than their share of criticism, it's argued. This finger pointing at the fan is not fully justified. The fan is doing a job that the design dictates. It reflects design sins committed in other cooling system components. Inadequate water flow, poorly designed air passages, and confining space limitations will show up as fan noise.

Fan noise is largely a function of horsepower. Anything in the cooling system—involving either water or air—that increases the load on the fan, also will increase its noise.

The dominant frequency of a fan is a function of its speed times the number of blades, divided by the number of groups of blades. So by varying the number and spacing of blades and speed, the sound can be changed within broad limits. Three-bladed fans are good on this score since their sound approaches the soft, swishing sound of the flow of air.

With today's emphasis on V-8 engines, low mounted fans, and large generators, the discharge side of the fan is badly located. True axial flow no longer is possible. To help this situation, the tips of some fans are being curved backward. That gives a cone-shaped discharge and allows the air to slide around the side of the engine.

Pump Load Upped

Water pumps are said to be another very much abused item in the cooling system. Engine horsepowers are increasing and transmission oil coolers have been added to the system; yet little work has been done to increase water flow capacity. So water temperature rises of 15 to 18 F are common. Experience has shown that anything over 10 F will need more air.

Engineers who design water pumps say these units should have adequate capacity and the entire intake system should have uniform speeds not over 10 to 15 fps. The volute velocities should be about 70% of that. Staying within these limitations will keep the pump free from cavitational characteristics. The impeller design should have a good pressure-flow curve so that slight changes in system restriction will not bring large changes in flow.

Thermostat engineers feel the design of their small unit ties in directly to all other parts of the

cooling system, even with the fuel and lubrication systems. They say that the proper type thermostat can team up with the influence of vapor pressure to build up peak cooling efficiency at 180 F operating temperature. This peak circulation can be used to solve detonation problems.

How the thermostat can affect temperature-flow characteristics of the open and pressurized cooling systems is shown in Fig. 1.

In the Customers' Hands

Once the motor vehicle gets out to the motoring public, things start happening to the cooling system. True, the vehicle owner pays a price because of mass production economics. But despite the price industry pays to furnish plus safety factors, owners still will neglect and abuse their vehicles to bring so-called normal malfunction.

Troubles can start with the water that's added to the cooling system. Water with as little as 200 parts per million of chlorides and sulphates will likely stimulate corrosion of cooling system metals. Hard water containing more than 500 parts per million of calcium or magnesium will bring noticeable mineral scale formation. That's particularly so in high-mileage operation where large quantities of make-up water are needed because of cooling system leakage or overflow.

A suitable corrosion inhibitor always should be added to the water. Even mineral-free water will corrode and form rust.

Corrosion protection should be maintained as near full strength as possible the year around. Fortunately, that notion is gaining pretty wide acceptance. The ideal practice is to install a completely fresh filling of inhibited antifreeze in the fall, to drain and discard the solution in the spring, and to add a dose of summer rust inhibitor to a fresh filling of water for warm weather driving.

Rusty coolant or rust deposits in the radiator signal the need for preventive cleaning. That's just a matter of adding an alkali or acid cleaner to the cooling system, flushing it through with the engine running at operating temperature, and then following up with a neutralizer solution.

Car owners can't go too far wrong in selection of antifreeze. Salt and oil type antifreezes have been excluded from car factory recommendations for many years. Suitability of antifreeze base materials has been officially settled by technical, governmental, and business organizations, as well as by Federal Trade Commission action and the antifreeze laws of 15 states.

Long use has shown properly inhibited ethylene glycol, methanol, and ethanol to be suitable. Glycol antifreezes are classified as high boiling point type and alcohol antifreezes as low boiling point type. Vehicle operating conditions, climate, and altitude are some of the factors going into antifreeze selection.

The high boiling type glycol type is said to be especially suited for new postwar engines. This type seems to be particularly well fitted to higher heat loads, coolant temperatures, and pressurizing.

Right now the industry seems to be concerned with cylinder head joint leakage. It brings crankcase oil contamination, coolant shortage, and loss of antifreeze protection. One school of thought has it that a new approach to cooling system design and construction is indicated if anything resembling permanent leak-tightness is to be achieved. Part and parcel of this problem is a much-needed effort to raise the standard of cooling system maintenance. That'll take education of both serviceman and car owner.

Steering Assist . . .

. . . needed for smaller cars too. They as well as large cars can stand to gain from the added driving comfort and safety offered by power steering.

BASED ON PAPER BY **F. W. Davis** Consulting Engineer

WIDER acceptance of power steering for large vehicles is a certainty. We can look for a new concept of steering in the passenger car field. Steering will be easier and safer in every way. As with ratios in 1926, so today engineers are having a hard time trying to determine which is best as well as what to do about reversibility and feel. The public will furnish the answers.

By eliminating the effects of larger and softer tires and heavy front ends, power steering makes it possible to re-evaluate all the factors involved in the design of front suspensions and in the geometry of steering linkages. It seems reasonable, therefore, to expect not only steering ease and greater safety, but improvement in stability and cornering characteristics at all driving speeds and under all road surface conditions.

Those closely identified with power steering see its probable adoption in the small sized quantity production passenger car. (Paper, "History, Development and Application of Power Steering," was presented at SAE New England Section, Cambridge, Mass., April 1, 1952. It is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members; 50¢ to nonmembers).

Why We Need Custom—

WHAT would a modern high-compression engine like in the way of a transmission? Before trying to answer this interesting question from an engine designer's viewpoint, one very important ground rule must be laid down. The authors will show what the engine wants the transmission to do, but will take no responsibility for designing a transmission to do it.

Much time and effort has been spent on transmissions, and today's excellent automatic transmissions are the result. But, up to the present time, these transmissions have generally been developed with the object of making driving easier and more comfortable. However, substantial gains in fuel economy could be realized if transmissions more effectively utilized the potentials of modern high-compression engines.

How great is the incentive to fit transmissions to engines better and vice-versa? This can be shown by analyzing ideal engine-transmission relationships.

Ideal Engine-Transmission Relationships

To begin the analysis, let's look at a typical curve (see Fig. 1) which shows the relationship between brake specific fuel and brake horsepower for an experimental engine run at constant speed of 2000 rpm. (This 253 cu in. engine was built to operate at 7.7 compression ratio on regular gasoline.)

The curve shows how specific fuel consumption varies in the cross section between road load and performance power. It is obtained by leaning the A F mixture from point A, the mixture ratio at which the engine develops maximum power, to B, where it develops best economy. The throttle is closed from wide open at B to the throttle opening required to develop road load horsepower at C. The specific fuel consumption at point B is only a fraction of that at point C.

Fig. 2 shows the relationship between specific fuel consumption and brake horsepower for the same engine under a wide variety of operating conditions. One might look at Fig. 2 as a character sketch of the engine, because it discloses a great deal about how the engine will respond to almost any operating conditions.

When enough individual cross section curves are included, the whole group can be enclosed by an enveloping curve. It is apparent, therefore, that if the ideal transmission is to deliver best economy, it should permit the engine to operate on this curve at all times. In other words, the transmission controls should always adjust the engine setting to operate at the point of minimum specific fuel consumption.

To illustrate the method of arriving at the engine-transmission relationship for best economy, the following typical conditions will be discussed:

1. Minimum engine speed.
2. Typical point of minimum specific fuel consumption.
3. Typical performance calculation.
4. Engine limited to speed of maximum horsepower.

First, the power required to drive the car at vari-

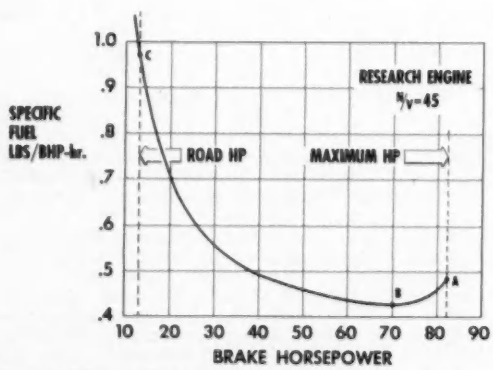


Fig. 1—This curve shows how specific fuel consumption of a 7.7 compression ratio engine varies from road load to performance power

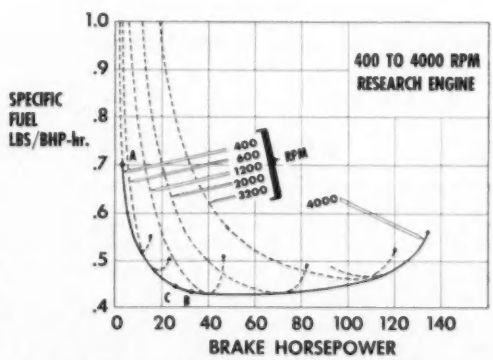


Fig. 2—An ideal transmission would permit an engine to operate at all times on the curve of minimum specific fuel consumption

Tailored Transmissions

D. F. Caris and R. A. Richardson
Research Laboratories Division, General Motors Corp.

Excerpts from paper, "Engine-Transmission Relationship for Higher Efficiency" presented at SAE Summer Meeting, Atlantic City, June 6, 1952. This paper will be published in full in SAE Transactions.

ous speeds is computed. For this the following formula is used:

$$Hp = \frac{(KW - K_1AV^2)V}{375}$$

where K = 0.012
K_1 = 0.00125
W = test weight (car weight + 600 lb test weight)
A = projected frontal area, sq ft
V = car velocity, mph

In this analysis a stock car having W = 4000 lb is used.

Fig. 3 shows such a road load power requirement curve for a standard stock car. Note, for example, that 3.2 bhp is required to drive the vehicle at 20 mph on a level road. Referring again to Fig. 2 it can be seen that 3.2 bhp is developed at point A on the curve of best economy. At this point the engine uses fuel at the rate of 0.70 lb/bhp/hr, from which the mpg can be computed from the relation:

$$Mpg = \frac{N \times C}{F \times P}$$

where N = miles per hour
C = lb/gal of gasoline
F = specific fuel consumption, lb/bhp/hr
P = horsepower

Arbitrarily, the minimum speed of the engines used in these studies was limited to 400 rpm, which accounts for the relatively high fuel consumption at point A. In choosing 400 rpm as the minimum speed, the authors are fully aware that it may be on the low side for present engines. However, remember that the object of this analysis was to establish the ideal engine-transmission relationship for best economy.

The second typical condition illustrates the point of minimum specific fuel consumption. From the road load power curve, note that at 60 mph it requires 26 bhp to drive the car on a level road. Fig. 2 shows that at 26 bhp, point C on the curve of best economy, the engine uses fuel at the rate of 0.445 lb/bhp/hr, as compared to 0.70 lb/bhp/hr at 20 mph where the 400 rpm minimum speed limitation made it necessary to close the throttle to meet road load horsepower requirements.

The third condition which must be considered is required performance, represented by acceleration and hill climb in the car. Under the operating conditions selected, 30.2 bhp would be required, in addition to the 3.2 for road load, to drive the 4000 lb stock car at 20 mph. (See Fig. 4.) To develop this 33.4 bhp and still keep on the best economy curve, the transmission would obviously have to permit

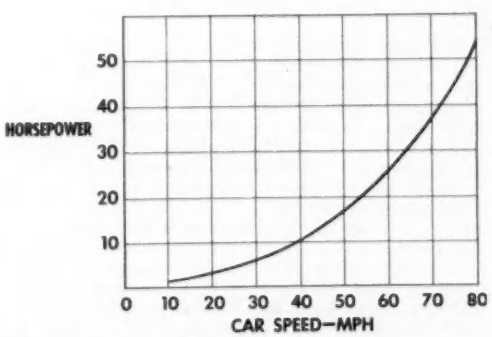


Fig. 3—This curve shows the engine-transmission relationship for best economy for a 4000 lb stock car

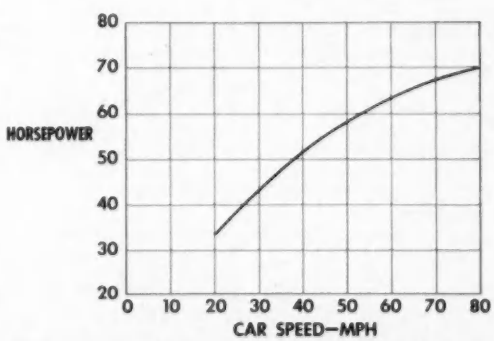


Fig. 4—Horsepower required at the rear wheels of the stock car for selected acceleration and hill climbing performance conditions

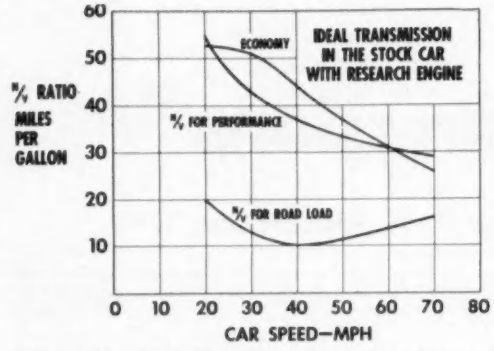


Fig. 5—Constant speed, level road fuel economy for 7.7 compression ratio research engine when equipped with an ideal transmission

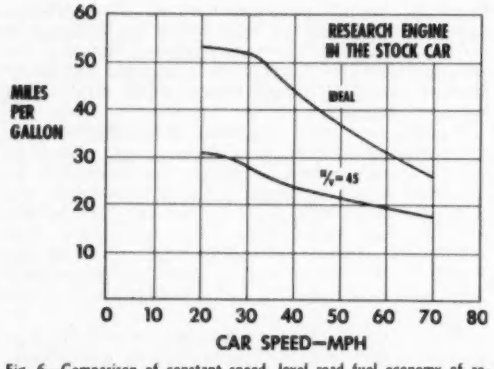


Fig. 6—Comparison of constant speed, level road fuel economy of research engine with ideal and standard (fixed N/V ratio) transmission. An ideal transmission would make possible gains in fuel economy of 70 to 48% over the speed range from 30 to 70 mph

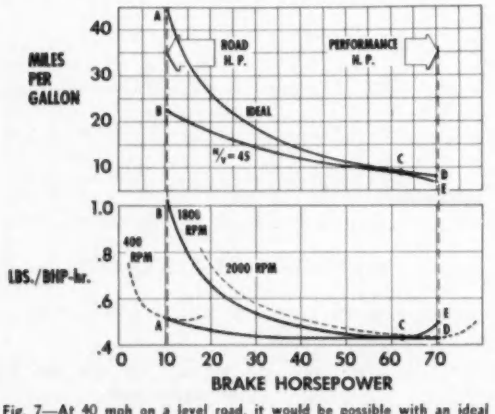


Fig. 7—At 40 mph on a level road, it would be possible with an ideal transmission to almost double the fuel economy obtained with a standard (fixed N/V ratio) transmission

the engine to increase its speed to 1100 rpm (point B).

Pick Best Engine Speed

Thus, it can be seen that with an ideal engine-transmission relationship, the transmission should act as a moderator to keep the engine always operating at best efficiency when developing the required power. Once the desired performance speed is determined, the relation between engine rpm and vehicle speed (N/V) can be established. The transmission controls would pick the engine speed to develop the required horsepower at a point of minimum fuel consumption.

Fig. 5 shows the level road, constant-speed fuel economy over the speed range from 20 to 70 mph resulting from the above ideal engine-transmission relationship, assuming no losses between the engine and road. Also shown is the road load ratio of engine rpm to car speed (N/V) and the N/V to give the stock car performance over the speed range. But fuel economy figures such as these are difficult to evaluate unless they can be compared with a familiar yardstick.

Fig. 6 compares level road, constant-speed fuel economy with two types of transmissions, the ideal and the fixed N/V ratio or standard transmission. The curves were computed without considering loss in efficiency between engine and road in either case. (It was felt that, from the engine man's standpoint, it was fair to ignore transmission losses in this study since they vary with the mechanism used to obtain the results.)

The figure shows that use of the ideal transmission would make possible gains in constant-speed fuel economy of 70 to 48% over the speed range from 30 to 70 mph. This analysis presents what is inherently possible from the engine standpoint. How much of this would be obtained would depend upon the transmission design; but even allowing for large losses, a large potential gain would remain.

However, automobiles are not driven on level roads at constant speeds very much of the time. Fig. 7 is presented to show how operating conditions would affect the gains in economy realized from use of an ideal transmission. The two curves shown in the lower half of Fig. 7 illustrate the relation between specific fuel consumption and brake horsepower for the experimental engine in a stock car run at 40 mph.

The ideal transmission would permit the engine to follow the best economy curve, whereas the standard transmission—with fixed N/V ratio of 45—would force the engine to follow the other curve. The stock car requires 10.5 bhp to propel it at 40 mph on a level road. On the best economy curve at point A, 10.5 bhp can be developed at 400 rpm with fuel consumption of 0.518 lb/bhp/hr, while it requires 1.02 lb/bhp/hr to develop the same 10.5 bhp at 1800 rpm (point B) on the fixed N/V curve. Now, point B is equal to 22.4 mpg and point A corresponds to 44 mpg as plotted on the upper set of curves. It is apparent that under these conditions it would be possible to almost double the miles per gallon if an ideal transmission were possible.

The curves of Fig. 7 also show that, as the throttle is opened with the standard transmission, fuel con-

sumption is rapidly reduced until at C, with the throttle open, it exactly equals the fuel consumption with the ideal transmission. At E, corresponding to 70.5 bhp required for full performance at 40 mph, the standard transmission has required the engine to cut in the richer A/F power mixture, while the ideal transmission has permitted it to increase the speed to 2000 rpm and develop the 70.5 bhp without enrichening (point D).

This ability of the ideal transmission to let the engine operate in the lower speed range without enrichening would result in 10 to 15% improvement in economy over present transmissions whenever engines were operated at full throttle. At higher car speeds it would, of course, be necessary to enrichen the A/F mixture to obtain performance and top speed.

The ideal transmission would obviously limit the top speed of an engine to the point at which it develops maximum power. In some cases this would result in lower specific fuel consumption and slightly higher top speed.

Boost Economy Six Ways

Analysis of Fig. 7 discloses several important facts about the gains in economy possible with an ideal transmission.

1. Greatest improvement in economy would occur at road load, about 98% in this case.
2. Improvement in economy would rapidly decrease at greater loads.
3. Since drivers continually operate between road and performance power, overall gain in tank mileage would obviously be much less than the 98% obtained under constant speed, level road conditions.
4. The effect of country and city types of driving on economy would be greater with the ideal transmission. However, use of the ideal transmission would always result in improved economy under all conditions.
5. With the ideal transmission, road load economy would be independent of performance, while with the standard transmission the greater the performance, in general, the lower the road load economy.
6. The higher the performance factor, the greater would be the economy gains resulting from the ideal engine-transmission relationship.

In the foregoing discussion, an experimental research engine was used to illustrate gains to be had with an ideal transmission. It might be interesting to apply the same engine-transmission relationship to a standard production car and engine.

The curves in Fig. 8, represented by solid lines, show level road, constant-speed economy of the standard car compared to the same car with an ideal transmission. Both curves were computed by assuming no losses between the engine and the road. It is apparent that improvements of 70 to 30% are possible in road load economy over the speed range from 30 to 70 mph with the ideal engine-transmission power package.

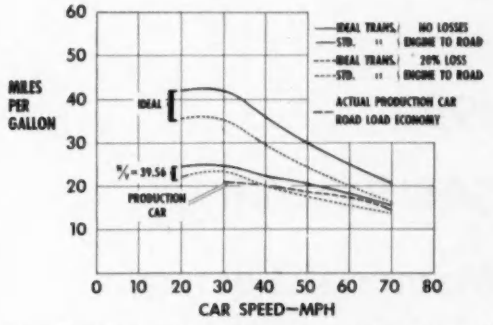


Fig. 8—Comparison of constant speed, level road fuel economy of standard production car and engine-transmission with that of same car and engine equipped with ideal transmission, assuming no loss and 20% loss between engine and road

In computing the dotted curves shown in Fig. 8, a 20% loss in efficiency between engine and road was arbitrarily assumed. Actual values of mpg have been reduced in both cases; but even under these conditions, a 60 to 18% improvement in economy would result.

The foregoing analysis clearly shows that very substantial improvements in economy can be accomplished with an ideal engine-transmission relationship. While it is difficult to assign firm values to the possible gains without benefit of actual tests, it is believed justifiable to predict a future overall saving of 25 to 35% in the nation's fuel bill by transmission developments.

(Paper on which this abridgment is based is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members, 50¢ to nonmembers.)

Based on Discussion

The challenge to design an ideal transmission to overcome the deficiencies of internal combustion engines was not denied by the transmission men who commented on this paper. However, several thought that the objectives might be more easily reached through engine improvements.

As one expert noted, reduction of engine friction would eliminate high power losses. This, in turn, would be reflected in greatly improved fuel economy.

What's more, the aerodynamic aspect of car design shouldn't be overlooked, chimed in another discussor. Streamlined designs that reduce wind resistance can contribute appreciably to better economy.

To another engineer, *the ideal engine* might be a variable displacement engine, then the ideal transmission could simply be an extension of the crankshaft to the differential.

In a more serious vein though, the thought was that the ideal transmission will develop through evolution as a result of the continuing effort of industry.

1952 SAE Beecroft Memorial Lecture

Traffic Law

I AM especially honored by the privilege of delivering this sixth David Beecroft Memorial Lecture and to be added to the group of distinguished men to whom this award has been previously given. It is with a feeling of humility that I accept this opportunity. The achievements which led to the granting of this award are the results of hard and devoted work done by the men and women who constitute the staff of the Traffic Institute of Northwestern University and the Traffic Division of the International Association of Chiefs of Police.

The Law and Organized Society

In approaching the problems of traffic law enforcement, I should like first to talk about law in general, and its meaning to us who live in an organized society. The law is one of the characterizing symptoms of our civilization, and the quality of the law tends to reflect the quality of that civilization which produced it. At its best, it tends to make it possible for civilized people to live together in peace and happiness. In this connection one of the major purposes of the law is the restraint of those persons and the prevention of those acts which tend to obstruct and limit the peace and happiness of society.

This philosophy prevails in all organized relationships—not only among men, but among nations. We recognize this in the need for international law and order, beginning, in our day, with the establishment of the international court at the Hague, the establishment of the League of Nations, and the necessity, urged by many, for the development of a world police force under the United Nations. All these actions are directed at the same objective—a society of men and nations under law.

Since the ends of law are the promotion of justice and the protection of welfare, it must serve no masters save those who have designed it for these purposes.

The law becomes a mockery when it is reduced to the service of special privilege. This is precisely what has happened with respect to large areas of law enforcement. Traffic law enforcement is one of these areas. The citizen, charged with a minor offense, exhausting every means to have his case disposed of other than by a trial on the facts and the law, is common to every city and state. Unfortunately, many of our officials, both executive and judicial, yield to such pressures. In some cases, the extension of such privileges is encouraged as a device for currying public favor and a means of dispensing political patronage. Such activity is destructive of enforcement and corrosive of the law, weakening the foundations of our society and its government.

All of the freedoms and privileges that are ours to enjoy, and all of our economic and social opportunities, depend upon law and its enforcement. Obviously, law is ineffectual without enforcement—courageous, just, impartial enforcement which carries out the true intents and purposes of the law of which it is the outward sign.

We can have law enforcement of such quality only when the public is informed of its importance to the well-being of the whole community, and when this results in honest support for the law and for the efforts of the police, courts, and other constituted authorities in its enforcement.

Almost certainly, a public so informed will put better men into public office to do the job. And, taking into account the corrupting power of special privilege, it takes good men indeed to serve the public without fear or favor. This is one of the paradoxes of our free democratic society.

But even with honest men in office, the public is frequently fickle, indicating need for a better understanding of law and its enforcement in relation to the welfare of all. We need a better public understanding of elementary civics, and at the same time we need to train better, more able, more ethical government administrators at every level and in every branch of our government.

Traffic Law and its Enforcement

But now, let us look at traffic law enforcement in

Enforcement

by Franklin M. Kreml

Director of the
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the light of these considerations. Its purpose, like that of general law enforcement, is to offset selfish motivation and to condition community habits through conditioning of the habits of individuals. It is a basic requirement in the orderly economic and social development of street and highway transportation. Traffic law, like any body of law, is sterile unless it is inherently sound, and supported by effective enforcement machinery.

Since it affects human conduct directly, traffic law enforcement, whenever adequate to the problem in both quality and quantity, produces substantial and sometimes brilliant results. Where such productive enforcement is continued over a period of years, community habits are improved to the extent that less enforcement is necessary to maintain the more orderly and safer conditions thus produced.

There are many outstanding examples of the effect of traffic law enforcement, intelligently conceived as part of a well-balanced over-all traffic supervision program. Among these are Detroit, Los Angeles, and Seattle. In 1937, Detroit undertook the planning and activation of a sound traffic supervision program. In that year, Detroit experienced 335 fatal motor vehicle accidents. In the following year, fatal accidents in Detroit totalled 196—a reduction of 41% from the previous year. In 1941, Los Angeles put into operation the same kind of a program. In that year, there were 518 fatal accidents in Los Angeles. In the following year there were 320, representing a drop of 38%. In 1945, Seattle experienced 109 fatal accidents. In the following year, following the installation of an intelligently conceived program, Seattle recorded only 80 fatal accidents—a drop of 26% from the preceding year. The fact that *when enforcement increases accidents go down* is clearly demonstrated in these three examples, which are typical of many that could be cited.

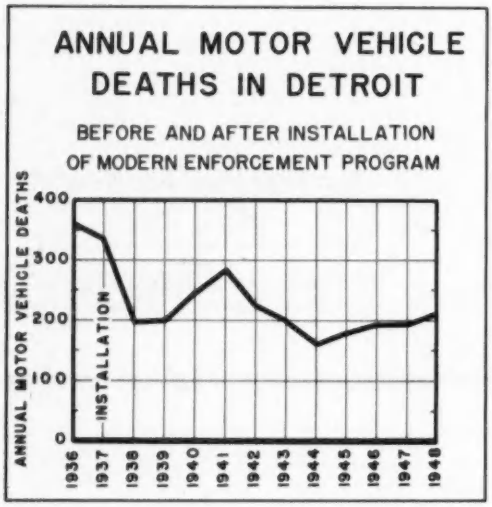
The value of enforcement is materially increased when police enforcement action includes the intelligent and wide use of admonitions, written warnings, and the giving of instruction to pedestrians and drivers, in addition to citation and arrest activity. It is increased when the courts not only penalize but exercise their authority to cause the reexaminations of drivers who are apparently deficient in necessary driving skills, when they recommend training in schools operated under the supervision of the court for those who are not adequately informed of their responsibilities under the law. It is increased when the irresponsible, immature driver is placed under the supervision of probation officers. It is increased when the driver-licensing authority supplies the court with information on the past violation and accident records of defendants and is, in turn, supplied full information by all enforcement and judicial agencies, on the basis of which prompt drivers' license suspension or revocation action can be taken.

Such combined action, based on sound laws and ordinances, is no vacuous hope—no dreamer's ideal. It is a substantial fact in many jurisdictions. Were this not so we would be killing and injuring many thousands more people each year.

We must recognize, and should be grateful for, the excellent traffic law enforcement work being carried on in many of our cities and states by police, courts, and driver-licensing officials. Without their intelligent, courageous action, their arduous effort over long periods of years, in the face of many disheartening difficulties, often including lack of public understanding and appreciation of their work, we would not today enjoy the lowest motor vehicle death rate in our history. Enforcement has been in the vanguard of the attack that has produced a reduction of over 50% in the fatality rate in the past 15 years.

But traffic law enforcement is not self-sufficient. It depends, to a considerable degree, upon education and engineering. Education and engineering have an important effect upon the quantity and quality of traffic law enforcement which may be required to secure street and highway safety.

Traffic engineering makes compliance on the part of the driver and pedestrian easier, and broadens the latitude of action for the driver and pedestrian without increased hazard. Less enforcement is re-



quired, therefore, and at the same time, such enforcement as is required is made easier to administer. Education, here perhaps better described as public information, broadens the exemplary influence of enforcement, as it can broadcast information on the penalizations of violators through the media of public information. Further, and of great importance, it can develop the necessary public acceptance of and support for traffic law enforcement.

Thus, it is clear that enforcement leans extensively upon engineering and education.

The efficiency of education and engineering, like that of enforcement, depends to a great extent upon the quality of accident facts developed through police investigation, and thus upon enforcement activity. The effectiveness of driver licensing is largely dependent upon enforcement, for without it unlicensed drivers, under suspension or revocation, or having failed ever to receive a license, continue to operate.

It becomes apparent that operational coordination between enforcement, education, and engineering is vital to a successful traffic program, even as coordination of policy and objectives must be maintained among the several activities bearing upon traffic law enforcement—laws, enforcement, adjudication, and licensing. It seems equally apparent that, to attain ultimate success, the street and highway traffic program must be developed as an integral part of the street and highway transportation program; that street and highway transportation in all of its phases—including public transit—must be related through city planning, land use studies, and traffic and transportation surveys, to the realities of the economics of the overall street and highway transportation requirements of an entire city or state. Traffic law enforcement is an essential element in this process. Let us examine it, returning later to the questions of the coordination of its several elements, the coordination of traffic law enforcement with education and engineering, and the correlation with and of street and highway transportation.

Despite the great progress made by traffic law enforcement, particularly in the past 15 years, much needs doing.

Broad revision of laws, particularly of the procedural sections, is needed. Attention must be given to the reclassification of offenses, if we are not to face the alternatives of denial of justice to many or a fantastic expansion in the number of our trial courts. Therefore, from the law of arrest to our basic charters, we must reexamine the law, not only to assure adequate enforcement, but also to make it possible for our governmental machinery generally to adapt itself to this great new problem of traffic law enforcement.

Police organization, management, training, policy, tactics, and techniques—even recruitment—need to adjust to growing requirements more speedily and with greater purposefulness. A new philosophy of traffic supervision and expedition, recognizing a responsibility for law enforcement that achieves the ends of greater public safety and healthier economic and social development, must replace the old tradition of law enforcement for its own sake.

The courts must abandon the outdated, inadequate forms and procedures that deny thousands of alleged traffic violators their "day in court." Lay justices, an answer to the settlement of minor disputes in remote communities during the past century, do not bring to their courts the legal training, broad education, or technical knowledge that a motorized America, seeking orderliness and safety of movement combined with justice for the individual, demands and deserves.

Driver licensing must assume fully its important role of supervision of the privilege to drive—assuring that only the competent are licensed, and that the indifferent, careless, or reckless are curbed or denied the privilege. Thus the competence and responsibility of individual drivers will constantly be improved, with a resultant improvement in the mass driving habits of our 60 million drivers. Legislative changes, personnel training, reorganization, and, importantly, adequate financing, must be established before this activity can fulfill its great potential for improved driving.

To illustrate the need for important basic changes within the structures of these major activities related to enforcement, I have selected an example from the police—accident investigation.

Accident investigation has two principal objectives. The first is to ascertain the full facts of an accident. The second is to determine whether a violation was committed, and, if this be so, to secure adequate evidence to support a prosecution of the violator. The validity of these objectives is above question. Dependable facts about accidents are necessary before economical and really productive work can be done to prevent them.

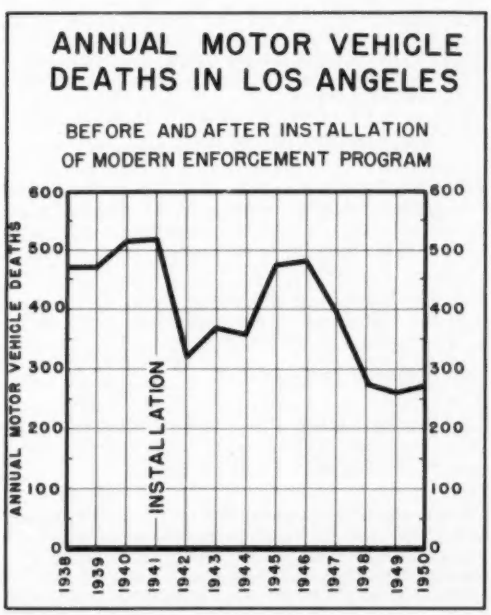
Notwithstanding this, in most jurisdictions there is little or no accident investigation activity, or its quality is so low that it does not deserve to be so called. Consequently, because of lack of adequate, dependable information about accidents, the entire traffic program fails to achieve the efficiency it

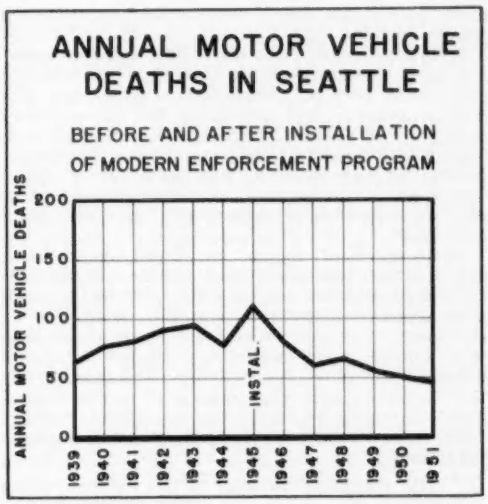
otherwise would. Serious violators who cause accidents are enabled to defy justice, while lesser violators, not involved in accidents, must stand charged before a court because of a simple circumstance of having violated a law in the presence of a police officer. This is both wasteful and inequitable.

So-called "accident investigation" is, almost everywhere, still only accident reporting. Our police need to be adequately trained and equipped, and then so organized, deployed, and supervised that this important function will be performed well. Accident investigation is just one illustration of the need for important basic changes in all of the components of traffic law enforcement, some of which have just been generally described.

There is urgent need for such change. Its urgency is evident in the 1952 figures of growth of the problem in its many phases:

1. Fifty-two million motor vehicles—from 29 million in 1945—representing one for each three people in the United States
2. Sixty million drivers
3. Half a trillion vehicle miles
4. A total of deaths which may reach or even surpass the previous all-time high of 39,969 in 1941
5. 1,250,000 persons injured
6. Direct economic loss of three and a half billion dollars





And the trend is up in each of these figures. The entire enforcement program must be improved greatly, and quickly, if we hope even to keep the problem in sight. If it is to be improved, laws, police, courts, and licensing must be improved. Let us now examine some of the major needs of each of these.

The Components of the Enforcement Program

Laws

The substantive laws in the traffic field are included in the Uniform Vehicle Code and the Model Traffic Ordinance, developed by the National Committee on Uniform Traffic Laws and Ordinances. Experience has shown these laws to be essentially sound and workable. Adoption of the Uniform Vehicle Code has been quite general. We have, in fact, a substantial degree of uniformity, particularly in rules of the road (Act V of the Code), throughout the United States. The Model Traffic Ordinance has been widely adopted by municipalities.

Among the states, rules of the road differ mainly in legal speed limits. These differences are natural, reflecting largely the varying terrain and road characteristics of the several states. The general practice of posting speeds largely obviates this difference so far as driver compliance and enforcement are concerned.

Much sharper differences between the several states in sizes, weights, loads, and the related vehicle licensing laws place a real burden upon enforcement and have deep economic implications beyond the scope of this lecture. Suffice it to say that a closer approach to uniformity in this important area is

essential to the sound development of highway transportation.

Failure of most of our states to meet the driver-licensing standards of Act II of the Uniform Vehicle Code is a real impediment to safety. The issue is not of lack of uniformity, but rather enactment of sub-standard legislation, which, in fact, amounts to no driver licensing of the quality intended by the National Committee on Uniform Traffic Laws and Ordinances.[1] This places an unreasonable burden of enforcement upon the police and courts.

Much good, of course, has been accomplished through the development and adoption of the Uniform Vehicle Code. However, the tendency to insist upon verbatim adoption of the code, unaltered, often leads to difficulties, particularly in connection with administrative sections—those governing police tactics in Act V, for example. Without adaptation to local needs, this sometimes results in unsound enforcement, defeating the basic objective. I cite from a recent report to the Arizona Highway Commission:

"The foregoing sections of the Arizona Motor Vehicle Law prohibit any police officer who has apprehended a motorist in the violation of any rule of the road, including those concerning weight or size of the load and vehicle or its equipment, from taking the violator into physical custody and before a magistrate for the purpose of fixing bail to guarantee the motorist's subsequent appearance for trial, or for the purpose of holding him for trial, except when one of the following offenses has been committed:

1. Negligent homicide;

2. Driving while under the influence of liquor or drugs;

3. Failure to stop at the scene of an accident.

The exceptions to this are: unless the violator

1. Demands an immediate trial; or

2. Refuses to sign a promise to appear.

For all other violations and in all other instances, it is mandatory upon the officer to issue a traffic citation to the offender containing a notice to appear in court upon a date not less than five days after the date of the offense—unless the offender demands an earlier date—and to release him on the road immediately, free to go his way."

* * * *

"Information received indicates that the number of non-residents failing to appear in response to traffic citations is steadily increasing—in spite of the fact that they have given their written promises to appear. As more motorists become familiar with this new law and as more police officers adhere to its provisions, the number of violators who fail to appear will increase. Too many violators, when there is no bail at stake to compel court appearance, will deliberately ignore any written promises to appear, particularly when service of subsequent warrants is impracticable or impossible. This situation has been demonstrated in California which has a law substantially the same as Arizona in this respect. The headquarters of the California Highway Patrol has on hand over 100,000 unserved warrants for traffic offenses. None of these warrants are more than five years old. Unserved warrants older than that have been cancelled by executive order."

We must look forward to numerous improvements in organization and administrative techniques necessary to bring our police, courts, driver licensing, and other public agencies abreast of the traffic problem. In so doing, we find need for rearrangement of the model legislation contained in the Uniform Vehicle Code. Such adjustment should be continuous and planned, so far as we can make it so, rather than sporadic tinkering to meet the demands of one group or another.

To this end it seems to me to be highly desirable, especially from the viewpoint of enforcement, that we soon reconsider the groupings of the ideas which have gradually been arranged into five acts. Such a regrouping—with the parts more nearly coinciding with the several administrative fields—would make it possible more easily to plan the development of our guiding legislation. As an example of the problem in the present code, I cite the lumping together of two quite unlike subjects in the fifth act. Here are treated together the rules of the road telling drivers how to behave on the highways, and the requirements for vehicles with respect to condition, size, and equipment. Although the people interested in one rarely are much interested in the other, they must meet together to consider amendments in the act as a whole.

Certainly we could benefit by having a group of acts relating to such subjects as:

1. The Vehicle—size, performance, equipment, titling, registration, inspection. This arrangement suggests the administrative economies of combining these operations.

2. The Driver and other road users—behavior on the highway and, for drivers, licensing.

3. Financial responsibility.

4. Administrative provisions—enforcement organization and administration, and necessary definitions of terms for all acts.

Such regrouping need not immediately modify any of the existing internal provisions of the code, but would better organize the code for future systematic improvements.

These revisions in the code should be drawn with

[1] South Dakota has no driver's license legislation.

a view toward general reclassification of traffic offenses, to permit simpler administrative disposition of minor cases, the only alternative to the present cumbersome handling of such cases under our criminal processes. The public will not and should not be required to await a lengthy uncertain process of general reformation of criminal procedures, state by state, involving, as it does in many states, constitutional amendment. The downgrading of most traffic offenses to a non-criminal grade is quicker, and, I believe, will more certainly assure traffic law defendants of a trial.

Nevertheless, there must be some amendment of our basic laws. Badly needed court reorganization, to be discussed later, cannot otherwise be effected. In almost all our states, the adoption of a modern system of courts is dependent upon constitutional amendment. Many serious cases, such felonies and grave misdemeanors as automobile homicide, driving while intoxicated, leaving the scene of an accident, and reckless driving, will, perforce, still be tried under criminal procedures. Thus, while reclassification of traffic offenses would remove a considerable part of this case load from our courts, our present trial system is, in the main, inadequate to hear and dispose of the remaining important case load.

In some cases, revision of basic law is necessary to provide the executive branch with authority to cope effectively with street traffic and transportation. Thus, some city charters, written in another age, make no provision for, but rather—by implication—forbid the reorganization in the executive branch necessary to provide for a consolidation of widely dispersed functions and authority over streets and traffic. Traffic management is therefore made costly and difficult, doomed too often to failure for want of the means of effective coordination. In many cases, such difficulties can be overcome by the establishment of appropriate staff agencies responsible to the Chief Executive—state or municipal. This will be discussed later. It is not to be inferred from this latter discussion that a department of traffic, in the executive branch, is being broadly recommended. Desirable and effective as such a department may be in some situations, I believe that the establishment of such a department would, in most cases, violate fundamental principles of governmental organization so seriously as to negate its other values.

Police

This brings us to that highly important member of the enforcement team, the police officer. It is a truism to observe that, without the work of our enforcement agencies, there is no enforcement—in fact, no law. If we are to have better traffic law enforcement we must have better general police service, for the traffic work of a police department cannot fall very far below, nor for very long rise much above, the level of efficiency of the general police service. It is true that the development of effectively organized programs within one bureau or division frequently has helped to raise the level of performance throughout the department, but only to a compromise level.

Some of the more important fundamental problems of the service are organization, administration, training, and recruitment. To the latter is related the knotty question of compensation.

As now organized, the police service of the country is literally unmanageable. For example, in Cook County, Illinois, the 8,000-man Chicago city police department shares the policing responsibility with a 600-man Park District police force, while in the suburban areas of the county, police departments (with forces up to 100 men) endeavor to cooperate voluntarily with Chicago, the Park District, and each other. On the rural highways of the County, Sheriff's Highway Police and State Highway Police share completely overlapping geographic jurisdiction with each other, and, in the Forest Preserves of Cook County, with the Rangers, essentially a county park police force. Although this is not precisely a typical situation, it is a fair example. There are worse.

The need here is obvious. The police of Cook County should be consolidated into one metropolitan force, policing all of the county. The State Police should police the rural highways outside of the metropolitan area. They should offer police service on a contract basis to the very small communities of the state which cannot support effective police departments with the overhead of training, equipment, and supervision necessary. This will be difficult of accomplishment, but it must be done.

Complicating this problem in organization is the fundamental ideological difference between leaders in the police service regarding the desirable degree of specialization for traffic in the police services of our cities.

On the one hand is the belief that the problem of traffic and accidents is so serious and has reached such proportions that it is necessary to specialize highly in order to provide an adequate level of enforcement to stem a rise in fatalities and injuries that amounts to an emergency. Such specialization produces some inefficiencies and is to some degree inconsistent with sound philosophy for the organization and development of the police service.

On the other hand, there are those who believe that we should at once place the responsibility for traffic law enforcement in the hands of the general uniformed forces of our city police departments. There is much to commend this latter viewpoint in theory. Theoretically, more men give attention to traffic, enforcement is more equitably applied, violations are deterred on a broader scale, and all of the advantages of traffic law enforcement accrue at a much greater rate.

However, training of the general uniformed forces in most of our city police departments today is such that it would be contrary to the public interest to place this added responsibility in their hands. Enforcement quantity and quality would deteriorate rapidly. In most city police departments, the problems of securing adequate reporting and investigating of incidents assigned to the uniformed force, adequate performance of patrol duties, maintenance of discipline, and similar problems, are still of major administrative concern. With fundamental training and routine supervision essential to the solution of these elemental problems still in the develop-

mental stage, we cannot hope that the much more complicated problems of traffic supervision can yet be turned over to the general uniformed forces with promise of good results. A relatively high degree of police traffic specialization is still required, and probably will be for many years.

Such organizational problems as these would try the most seasoned administrator. Not yet, however, are we providing any formal machinery for selecting, training, and developing general administrators and executives for this vital service. The police service has made almost unbelievable technical progress in the last 25 years. Moulage, for example, now in almost universal use throughout the United States, was an uncomprehended, almost unpronounceable word 25 years ago. But the management of our many police agencies is necessarily either in the hands of men who have had wide police experience but little training for or experience in administration, or, in a relatively few cases, in the hands of experienced administrators without police experience. Neither is a happy solution.

We must provide such training—for the present on an in-service basis—through our universities, particularly those which are distinguished for their successful development of managers for business and industry. The principles involved are virtually identical. Combined with years of police experience, such training would provide the quality of management so badly needed in most of our police departments.

But training cannot stop here. The staff, subordinate commanders, and the rank and file must be thoroughly, professionally trained. All but the very best of our in-service police training leaves much to be desired, even at this lower level. A police officer in 20 years of service may, in a typical department, be given 20 to 30 hours of training in the law. This is woefully inadequate. The competence of a police officer in the criminal law, laws of arrest, evidence, and constitutional law—by means of a continuing program of in-service training—should approach that of the graduate of an accredited law school. In terms of public necessity, it is at least as important to train the police officer in these matters as it is the student lawyer.

Recruitment of qualified men becomes increasingly difficult in periods of intense economic competition for manpower at relatively high wages, such as the present. The police service cannot compete effectively in this situation. But higher salaries, necessary as they are in some departments, are at best only part of the answer. The prestige of the service must be elevated. Perhaps the most important step in such elevation is the requirement of pre-service professional training. A modest beginning is necessary, perhaps employing the cadet system of part-time employment and part-time college attendance, to provide income during training and reasonable assurance of an appointment upon completion of study. But, in turn, the requirement of the completion of a full professional course of study must become a prerequisite to entry into the service. First, however, the service must set the objective and agree upon policies and programs. To pave the way for such a process, laws must be amended in many cases.

Such reforms in organization, enlightenment in administration, improvement in training, and selectivity in recruitment will provide the nation with a professonal police service of the first order—a service which will take the problems of law enforcement, including traffic law enforcement, in stride.

Importantly, such professionalization of the service will make it possible more skilfully to resist, and more competently to avoid, political interference with law enforcement. The public confidence and support which it will hold—because it is deserved—will give a confidence and esprit known now only in elite corps of the armed forces. This is deserving of our best thought and our most courageous support.

In the intervening years, before the police service comes finally into its own, we must give a maximum of training and service assistance to the police for meeting the explosively expanding problems of traffic. Without such assistance police traffic enforcement and supervision will be defeated by the size and complexity of the job, and the result will be traffic anarchy. Vehicles will be parked anywhere—everywhere; main traffic arteries clogged completely; accidents unattended; signs and signals disregarded; pedestrians marooned.

This is no idle dream, or nightmare. Such a situation has been approached within recent years in some of our cities, where circumstances such as transit strikes have, on a working day, required the use of most of the motor vehicles registered in the area.

The pattern of the assistance required is well established. It needs considerable expansion, refinement, and, most of all, development of basic data, information, and instruction in highly usable form.

The training of traffic police administrators is well under way. More departments need to take advantage of it. The training of technicians for staff and line specialist assignments has been embarked upon. It requires considerable expansion. Preparation of training materials for use at the technical and administrative level has been going forward slowly for many years. This must be accelerated, as must the very important, recently initiated development of training material for use at the operational level.

Administrative and technical field assistance has been offered since 1936 and is now in great demand. The facilities are being expanded as rapidly as funds permit. All of this work, carried on in the main by the International Association of Chiefs of Police and Northwestern University Traffic Institute, has been tangibly resultful. It is being effectively integrated with service in the courts, laws, and driver licensing, giving state and local government broad, substantial assistance in all areas related to traffic law enforcement.

The compelling police enforcement problem, however, is that of manpower. In states the problem is, with rare exception, one of sheer inadequacy. In cities it is one of effective use of the force available. In Mississippi, there is one state patrolman for 293 miles of state highway. Our largest state force, Pennsylvania, has one man for each 200 miles of highway. Adequate supervision in these circumstances is impossible. These figures, striking as they are, do not reflect the real extent of the manpower

shortage. They would be doubled or even tripled if they were computed in view of the necessity for several watches, vacations, sick leave, and days off. Moreover, time consumed for duties other than patrol, and patrol duties on roads not classified as state highways, is tremendous in some states. All this taken together results in a critical manpower problem in the state police forces.

Bold experimentation is called for in the use of aircraft with air-ground radio, radar, check points, mechanical control in speed zones, and use of traffic-dispatching techniques at radio-interlocked regulating points at key intersections. These are just a few devices and techniques that will increase the effectiveness of our highway police forces. But along with these there must be added, almost everywhere, more manpower, even though scientific devices will tend to ease the manpower problem. The immediate adoption of a host of such devices and techniques would serve only to keep the state forces barely abreast of the dizzily growing problem of rural traffic, particularly in our populous states.

In addition to the sharp increases in intercity travel—present total about 350 billion miles—the problem is made acute by whole urban-type residential areas and business districts which are developing in unincorporated areas outside of our metropolises. The responsibility for policing these areas is falling largely upon our state enforcement agencies. Only more manpower, better trained and equipped, can provide the enforcement necessary to hold down the appalling increases in rural traffic fatalities.

City police departments are, in general, reasonably adequately manned. Here the traditional preoccupation with crime and vice, a chronic shortage of available uniformed forces resulting from large overhead operations, the necessity of "coverage," and the depletion of daily available strength by court appearance, warrant service, and special details create remediable shortages. Added to these is the depletion of the traffic force available for accident investigation and general traffic law enforcement through the demands for constantly increasing parking enforcement and coverage of school crossings.

The principal need is for better management which will more carefully husband the available strength and employ it effectively in meeting the major enforcement problems of the community, among which is traffic.

In Chicago, for example, school crossings alone require almost the full time of 900 police officers daily. Most of these crossings require direction, but relatively few of them the attention of a trained police officer. Most of them can and should be manned by civilian guards. The release of even half[2] of these 900 men for traffic law enforcement duty in Chicago would result in a 30% plus increase in traffic law enforcement personnel, with a flexibility in their assigned hours of duty that could develop an increase of more than 30% in the level of traffic law enforcement.

Administrative procedures should be adopted that will tend to eliminate antiquated time-consuming methods that require a substantial proportion of departmental strength for relatively unproductive duties. Hundreds of thousands of man-hours are devoted yearly to the service of warrants following failure of the defendant to honor a citation, arrest notice, or summons. Despite this, tens of thousands of warrants are unserved each year. This burden would be materially reduced and response to citations improved by a broader application of the cooperative policy of suspending the licenses of drivers who have not appeared to answer charges. To make such a plan effective, the police, courts, and driver licensing personnel must cooperate fully in reporting to the driver-licensing authority.

Further, the burdensome task of parking enforcement would be lightened by increased use of government-operated towing services and pounds. The present uncertainty of apprehension, and the slight penalty invoked in most cases, make a "cat and mouse" game of this phase of traffic law enforcement. The towing of illegally-parked vehicles, particularly those which positively endanger or obstruct, would result in an immediate, marked improvement in observance of parking regulations, while reducing the necessity of enforcement.

Unless such action is initiated, traffic law enforcement will fail in its mission at great public cost in lives and dollars; importantly our police agencies will lose public confidence, with all of the sad results of such loss.

As one consequence of all this, the public—particularly civic leaders—are even now tending increasingly to demand or support demands for the establishment of separate traffic law enforcement agencies. In state police areas they have supported appropriations and legislation making it possible for other departments increasingly to take over traffic law enforcement work. Truck weighing, a traffic law enforcement function, has in some instances in recent years been set up under a separate enforcement agency, because the state enforcement agency, the State Police Department or Highway Patrol, did not wish to undertake this traffic responsibility. Some motor vehicle departments, even where organizationally separate from the Highway Patrol or State Police, have created sizeable uniformed highway enforcement units. Such a course has been supported by the public and the legislatures because of recognition of the need for a level and quality of traffic law enforcement not being provided by the general enforcement agency. This not only retards the development of the state enforcement agency, but defeats functional consolidation and its resultant economies.

Public demand for such separate traffic police forces is developing in some of our larger cities. During the last ten years, there have been several serious proposals for the establishment of a separate municipal traffic police department, reporting to the mayor. These are evidences of public and official dissatisfaction with the present quality of enforcement.

Such proposals are, I am sure, unsound. However, the public will pursue even an unsound course if there is no other apparent avenue to solution. All police agencies, as many have, must recognize

[2] The 900 crossings could be manned by civilian guards at a cost approximately equalling that of 450 policemen.

and embrace fully their responsibility for providing adequate police traffic enforcement.

Courts

No matter how excellent the traffic enforcement work of the police, it will be effective only if court action also is effective. In 1931, when the enforcement index was first developed, it became apparent that citations or arrests were unproductive unless followed by appropriate court action. Yet our courts, with some notable exceptions, as in New Jersey, are not adequate or sufficiently well organized to cope with the huge volume of motor vehicle violations. This condition is aggravated by the complexity of many of these violations, particularly in some cases developed through accident investigation.

Further, our court officials are, in the main, untrained to deal effectively with the problem of the traffic violator. Our law schools offer no training in this area. With rare exception, they offer no training for the public practice of the law, for the important responsibilities of prosecutors and judges. The in-service training program for traffic court judges and prosecutors of the American Bar Association and the Traffic Institute of Northwestern University is still not extensive enough nor is there broad enough acceptance of it to overcome this training deficiency.

In many jurisdictions, judges are still rotated through the Traffic Court—this being frequently considered an undesirable or even a "punishment" assignment. The judges thus assigned to Traffic Court are often indifferent, or incompetent to deal effectively with the problems of traffic. Thus, justice frequently fails both the defendant and the public.

Violations bureaus, particularly in our large metropolitan areas, are handling more and more cases each year, while traffic judges usually "hear" cases in one to two minutes. The traffic law enforcement work of the police is thus frequently nullified and the public is resentful at the failure of the courts and police to enforce the law. Defendants rail at the injustice of inadequate hearings, and resent the whole hurried process of traffic law enforcement.

Why, in view of this situation, is the Bar opposed to the processing of violations by bureaus or departments in the executive branch of the government? The Bar's position is sound. So long as we continue to classify all traffic offenses as criminal or quasi-criminal, we must, to protect against encroachment upon civil rights, give the defendant his day in court—in one way or another.

Defendants should not be required to wait long hours for the trial of relatively minor charges, with the result that other thousands of defendants, contrary to their convictions and beliefs, settle their cases in violations bureaus rather than spend the time required for court hearings.

Hearings should be readily available to all defendants. The violations bureau can perform a useful function if it is reserved exclusively for those who acknowledge their infractions. Hearing commissioners or referees under the jurisdiction of the court should be made available to hear minor cases, while our traffic court judges should have time to hear fully the most serious violations cases.

As discussed in the section on laws, we should begin by reclassifying traffic offenses in the Uniform Vehicle Code, so that only the most serious offenses —such as automobile homicide, driving while intoxicated, leaving the scene of an accident, and reckless driving—are classified as crimes to be tried under the established rules of criminal procedure. To illustrate, those who admit guilt for minor infractions—parking overtime, for instance—could settle their cases in a violations bureau, as at present. Those who do not wish to plead guilty would have a prompt hearing before a referee or hearing commissioner, with the right to review by a trial judge. Minor misdemeanor offenses—violations of stop signs and red lights, for example—would not be answerable in the violations bureau, but would be heard, in the first instance, by the referee or hearing commissioner, again with the right to review by the trial judge. Grave misdemeanors, of course, would be tried in the traffic court under the prevailing rules of criminal procedure.

Many of the important deficiencies in the courts stem from lack of training of our court officers. Trained primarily for the private practice of law, few judges sit in traffic court, and few prosecutors are assigned there for a period of time sufficient to learn to administer this important body of law. This situation is aggravated, of course, by the hundreds of trial justices, recorders, magistrates and Justices of the Peace who have had no legal training whatever. Further, court organization is generally antiquated, being geared to the procedures of trial of criminal and quasi-criminal cases in small volume.

For the training of the present generation of judges and prosecutors it is imperative that we provide more and much better in-service training schools and conferences. Longer courses of the type now being sponsored cooperatively by the American Bar Association and the Northwestern University Traffic Institute, and of substantially greater instructional value, must be offered to many more court officers and with greater frequency. The lengthening and improvement of these courses is now being undertaken. We must employ all reasonable means to bring traffic court officials into these courses. Annual attendance should be counted in thousands, not in scores or hundreds. The resultant improvement in traffic law enforcement and the administration of justice will be a rich reward.

Many of our traffic courts are in vital need of assistance in reorganization and in the rewriting of administrative and procedural rules, including the adoption of sound business accounting methods in traffic violations bureaus. Service facilities for the extension of such aid must be increased, and the demand stimulated. This is important to the internal efficiency of the courts. It is essential to the administration of justice and public respect for law. To take violations bureaus as an example, in one city processing of traffic tickets had at one time fallen 18 months behind, with a backlog estimated at 150,000 cases. Another city is currently 15 months behind, with a backlog of 156,000 cases. This situation could not develop in a well-organized

court employing modern business administrative methods, such as machine records systems.

An important step in reaching the objective of business-like administration of justice in traffic cases would be the establishment of sound and consistent policies of penalization within the courts. The extreme disparity of penalties for identical offenses invoked by judges of the same court amounts, in the public mind, to judicial caprice. Validity is lent to such a conclusion by traffic court action wherein, in one city, a judge found 80% of those charged with driving while intoxicated guilty, and assessed substantial penalties in almost all cases. During the same period, another judge, of the same court, found less than 20% guilty, and assessed penalties averaging about 25% of those of the first judge. In the month following revelation of this situation by a metropolitan newspaper, the latter judge trebled both convictions and penalties

As a consequence, defendants and their lawyers cynically "shop" for "easy" judges. The judicial system, an opponent in a game, is held in light contempt.

Inflexible uniformity of penalties is undesirable and would deny the intention of the legislature. However, broadly consistent policy, within a given court at least, would largely remedy the inconsistencies which reduce the educational result of the enforcement process, and would strengthen public confidence in the law and its administration.

But, while in-service training and field assistance can materially improve our traffic courts, other kinds of action also are required. Training for the responsibilities of administering our court systems should be included in the curricula of our law schools. Candidate lawyers should be trained for that public responsibility which many of them will assume as judges and prosecutors and which all of them should fully understand. Such understanding is particularly important because of the increasing influence of the organized bar in initiating or passing upon court reforms, and the exercise of virtual veto of nominations of judicial candidates. Many of our medical schools and colleges are recognizing their responsibility to train or stimulate and guide the training of public health officers and even hospital administrators. Our law schools must recognize a similar responsibility in the administration of justice.

Progress must be accelerated in the fundamental reorganization of our state court systems. This point was developed, in part, in the discussion of the laws. We all have an appreciation of the organizational inadequacy of the polyglot system of municipal courts, recorders courts, magistracies, and Justices of the Peace—an inadequacy which, under the greatly increased volume of traffic cases and the need for their prompt, just disposition has, in some cases, amounted to a breakdown in the court system. Under our present organization, the latitude of administrative action allowed to most of our courts contributes greatly to inconsistencies in process, procedures, rules, dispositions, and penalties among the many courts trying traffic cases in each state.

Organizational reform is badly needed in most of our states—desirable in virtually all. The tremendous improvement made possible by organizational reform throughout the court system of a state has been demonstrated brilliantly in New Jersey. The operation of the reorganized courts of that state—launched and directed by Chief Justice Arthur T. Vanderbilt—deserves serious study by all of us. The essential elements of such reorganization are:[5]

1. Administrative application of the hierarchical principle of organization, according to which there is a clear line of authority, or "chain of command," down through the various levels of the organization from the "top," central authority to the "lowest" operational level.

2. Area distribution of trial courts consistent with need.

3. Elevation of jurisdiction of all trial courts hearing traffic cases to the level of courts of record, with an accompanying rise in legal pre-requisities for judicial office.

4. Centralized rule-making authority, and some administrative disciplinary authority in the hands of a superior judicial authority; in New Jersey such authority is vested in the Supreme Court.

Such a court system improves police action and morale, reduces materially the application of the special privilege doctrine, nourishes the great potential of effective driver licensing, and, most importantly, more nearly fulfills its mission of combining justice for the individual with a maximum of public safety.

The need is for fewer traffic courts, more effectively organized, and conducted by adequately trained judicial officers. This improvement will come very slowly unless our efforts and those of the Bar and the public are bent more purposefully and determinedly toward its accomplishment. The only alternatives, however, are either a growing denial of hearing to the increasing number of defendants charged with traffic violations, or the creation of hundreds of additional judgeships at great public expense.

Driver Licensing

Driver-license revocation and suspension are, of course, vitally important to a successful enforcement program. With some notable exceptions, such as Massachusetts, California, and Texas, suspension and revocation are not being used effectively in relation to traffic law enforcement. In some cases the law does not permit revocation and suspension or makes them very difficult. In other cases, where the law is adequate, insufficient funds are appropriated for an effective job of supervision of drivers through revocation and suspension. In other cases, the job just isn't done. Sometimes this failure is due largely to the courts and their failure to report convictions, even though such reporting is required by

[5] See George Warren, "Traffic Courts," Little, Brown and Company, New York, N. Y., 1944.

the law in most states. In other cases, the driver-licensing authority in the State Motor Vehicle Department fails to act effectively.

Public awareness of an efficiently operated licensing system has a salutary effect upon the driving habits of most vehicle operators. The reason is obvious. Almost without exception, suspension—even for a short period—and revocation of the privilege of driving are depriyations which all wish to avoid. The conscious or subconscious recognition that the operation of a vehicle is a permissive act helps the driver exercise a degree of self-restraint which becomes habitual. In such a situation, voluntary observance of the traffic laws and the exercise of common sense becomes so widespread as to reduce measurably the required volume of police and court enforcement action. Thus the police and courts can devote primary attention to the reduced minority of incompetent or indifferent operators, and to the better enforcement of the driver-license law. Enforcement action is made more effective by the ultimate exercise or re-exercise of the license administrators' authority to suspend or revoke.

It is, I believe, true that the substantially lower death and injury rates in several of our eastern states—particularly Massachusetts—result, in the main, from the courageous and intelligent administration of the driver-license law. If this can be accomplished in some of our states, why not in all? There is general need for sound driver-license laws, and for effectively organized license bureaus, staffed by technically trained personnel. In the worsening traffic accident situation of today, primary attention should be given to the improvement of this vital operation.

Act II of the Uniform Vehicle Code is a workable act. That it has not been more widely adopted without emasculating amendment is a reflection of political compromise at the expense of public safety. The first step in the development of an effective driver-licensing program is the adoption of this act.

Happily, the American Association of Motor Vehicle Administrators has embarked upon a four-year training program for Chief Examiners, augmented by regional training for examiner instructors, and is intensifying its field service program in the area of driver licensing. This is promising work which, however, needs to be conducted on a broader scale and at a more intensive rate.

For the funds invested, no area of our work holds greater promise of early and marked reductions in the accident rate than does driver licensing. Its potential will be even greater if the direction of this important responsibility in the several states is placed in the hands of career public servants. This is a far more important objective than the resolution of the question of what niche in the organizational structure of state government this function shall occupy. Our preoccupation with this moot question has operated to the detriment of the improvement of driver license administration.

There is need in most of our states for more funds and larger staffs for the drivers' license agency. We have been penny-wise in the past. The resultant necessity of a single examiner conducting as many as 75 driver licensing examinations in a day has produced a poor result. No opportunity is allowed for the expansion and improvement of the examining procedures. For example, there is need to determine driving competence under varying conditions. A 15-mph trip around the state house in congested traffic is no criterion of the skill necessary to operate a vehicle at four times that speed on a two-lane highway over which other vehicles, buses, and trucks are operating at high speeds. Police and courts can do little to backstop this situation. They can only pick up the pieces and, if accident investigation is well conducted, fix criminal responsibility. The incompetent and chronically reckless must be dealt with primarily by the licensing authority. But, to be effective, this activity must be supported by police enforcement. Unfortunately, driver-license revocations and suspensions are frequently inadequately enforced, if at all.

Many incompetent persons are driving vehicles upon our highways. The constant violators, accident repeaters—even the accident-prone—are frequently permitted to go on driving though they have amply demonstrated their unfitness. Consequently, we suffer loss of public confidence in the licensing program, traffic law enforcement, and in the general efficiency and integrity of government.

Some Broader Requirements

Obviously the accomplishment of the objectives of better laws, better police and court action, and improved driver-license administration would sharply reduce accidents and greatly expedite the flow of traffic. We must, however, recognize the need for the coordination referred to earlier in this presentation—coordination of these several activities contributing to traffic law enforcement; coordination between traffic law enforcement and street and highway transportation; and finally the coordination of street and highway transportation with the transportation requirements of our cities and states.

The pursuit of different objectives by each of the several departments and bureaus of government responsible for the supervision, direction, and control of traffic, drivers, and pedestrians is costly and unproductive. Traffic law enforcement can be made easier, and the necessity for it reduced, if it is part of a fully coordinated, over-all traffic program. Simultaneously, traffic engineering and public education also will become more productive.

In recognition of the need for a coordinated program, the public has demanded consideration of the establishment of separate street and highway traffic departments, including all of the major traffic functions of government. I believe this to be an uneconomical and philosophically unsound proposal.

Leadership in the traffic field has countered with the Traffic Commission—a "kitchen cabinet" on traffic and street and highway safety. While sound in theory, and though aimed at bringing together all responsible department heads for the coordination of traffic programs, in practice the commission has generally fallen into the habit of discussing individual departmental progress and specific problems. The commission has failed, generally, to accomplish its purpose of creating coordinated plans for unified action.

Coordination at the operating level can be largely

effected, I believe, through the voluntary coordinating device of a common genesis of plans and activities. This may be accomplished best through the joint analysis of the situation and the facts—for example, joint analysis of the accident experience by engineers, police, public education, and driver-licensing personnel.

The intelligent administrator depends heavily upon the agency or individual in his organization who develops conclusions from the facts. If the several analysts—from the engineering, police, educational, and driver-license agencies—coordinate their thinking through such joint analysis, the administrative action of their several chiefs will usually be substantially coordinated.

Important though it is, such inter-operational coordination is not sufficient, for two reasons. First, there is a need for the interposition of authoritative coordination whenever the voluntary device fails. Second, there is a compelling requirement for the integration of accident-prevention and movement-expedition activities at the operational level with the much larger programs of city planning, land use, street and highway development, and transit, so that operational level activities may be fitted into and effectively contribute to the needed program for increased efficiency of a well-ordered street and highway transportation system.

In earlier times of fewer problems and a more leisurely pattern of life, such planning could have been accomplished under the immediate direction of the Chief Executive—the coordination effected by his own hand. With but few exceptions, this is not possible in government today.

The need, I believe, is for the establishment of an operating staff, responsible to the chief executive, to plan and program for the development of an adequate street and highway transportation system and to exercise staff control over development and operation of the system. Like any sound staff action, it could not, of course, be arbitrary. Heads of the operating departments would participate in planning and have opportunity to present formally minority-recommended programs. Finally, however, the executive and his technical staff would make decisions. Following this, staff inspection procedures would insure operating conformity by the concerned departments to guarantee effective progress toward the objectives.

For this top staff responsibility we need a new professional type. Grounded in engineering, economics, or transportation, he should have city planning experience or an appreciation of land-use principles and their application. His own staff should supply the technical knowledge and experience not present in his own education or experience. Thus, the combined staff would bring together training and experience in engineering, economics, transportation, city planning, and land use.

This, I believe, is more workable and less costly than would be the establishment of a department of street traffic—more workable because it integrates street traffic into the urban pattern of transportation—necessarily our goal, whether we now recognize it or not; less costly because it is a staff operation.

Conclusion

If all of these needs are to be met, and in time, we must all step up to the responsibility now. The alternatives are increased congestion, confusion, a rising toll of deaths and injuries, loss of public confidence, and intervention of the Federal Government.

While I am opposed, in principle, to such intervention in what is essentially a problem of our cities and states, I regret, even more, that we are failing extensively in this test of the adequacy of state and local government in dealing with a public problem of such vital importance to the welfare and security of us all. The only answer is for local and state governments to face up to the tasks which are properly theirs. By and large they have not done so.

National organizations, in order to help the states and cities, need two things—more and better people and additional funds. They themselves must secure these. The additional men can, of course, be found when the money is available. Some of the needed additional funds can, and should, come from the foundations and businesses which have a stake in the field. On the other hand I believe that, in the main, it should be provided increasingly by the cities and states who receive the training and service necessary to help them meet their problems effectively. Thus, service and training should be offered by the national organizations on a cost-recovery basis, to the end that they become self-supporting, or largely so, in the offering of this assistance.

From such income we will, of course, be able to employ the needed additional staff. When this becomes possible, we must embark upon a selective program of recruitment in which we seek out young men—not necessarily in our own field today—who show great interest in and aptitude for public work, and who show promise in the area of traffic, so that we may develop them for the leadership that this field will need so badly tomorrow. This personnel problem is, admittedly, a digression from the subject of traffic law enforcement, but it affects law enforcement as it does all areas of activity in this field. Traffic law enforcement cannot improve very much more than the whole traffic field improves.

If we are to face up to these serious and important responsibilities, secure the additional funds and manpower at the national level to give the training, service, publications, and other assistance required by officials at the operating level in our cities and states, we must recognize the gravity and dimensions of the problem, the rapidity of its growth, and the breadth of our responsibility. We must rededicate ourselves to that service of the American people which originally brought us into this work of such great opportunity and so many satisfactions.

Plastic "Toys" Are

CONFUCIOUS said a picture is worth 10,000 words. Shop men will quickly agree that this is true in the case of engineering drawings. But to Ford engineers one plastic model is worth 40 lb of blueprints. Why?

Plastic models replace thinking-on-paper designing with a see-it-in-the-flesh approach. (See Fig. 1.) They make it easy to come up with products "designed for manufacture." They improve liaison and teamwork between designers and manufacturing engineers . . . and, in the process, save time and money, too. Economies come from at least these five directions:

- Increased participation and contribution of manufacturing suggestions.
- Time saved in getting programs underway.
- Fewer engineering changes.
- Lower tooling costs.
- Less engineering man-hours.

Models Are Not New

Use of models as a development medium and as a means to spot potential manufacturing problems is not new. The automobile industry, among others, has long recognized the value of parts models as engineering tools.

However, the logical combination of models *as a medium* and plastics *as a material* has not been employed as much as it should be. Instead of using plastic, steel is used for prototype models—and herein lies the catch.

Steel models take too long to make and cost too much. One hand-made steel model, for example, cost over $4000 and took three months to make. But when the same assembly was made in plastic, it was produced for $150 . . . in just two days. In fact, the switch to plastic models saved Ford about $500,000 in model costs alone during the first few months of the plastic model shop's existence. (See Fig. 2.)

Cost savings then are great. But the primary reason for using plastics as building material for models is the tremendous saving in time. Models fall into the "needed yesterday" category. If they can't be obtained quickly, such benefits as time saved in getting manufacturing programs underway, fewer engineering changes, and lower tooling costs will not be realized.

That's why plastic models are so superior to steel ones. Plastic parts can be turned out in a few hours or days instead of the usual weeks required to make metal study models. Furthermore, when parts are are hand-made in metal, each duplicate part requires the same amount of work and time as the first part. However, in making plastic prototypes, once a form is made, any number of duplicates can be made readily in a few minutes and without further hand work except trimming. Plastic models, then, are available at the beginning of the development program—when they are really needed.

New Floods of Ideas

This, in turn, means new floods of ideas contributed by manufacturing personnel who normally would not suggest them until they had seen steel models at a much later date.

It might be well to point out here that key manufacturing engineers are always called in early in a product development program to spot design features that may create tooling and production problems. Unavailability of steel models at this time has necessitated that they pore over drafts, layouts, prints, and occasional photographs before coming up with their recommendations . However, it takes considerable time for even the most experienced manufacturing executives to analyze drafts and prints in sufficient detail to foresee future manufacturing problems. Many simply do not have time to devote to this.

Far too often, then, engineering departments proceed with designs and detailing without receiving constructive criticism from manufacturing personnel in the early stages. When prints are released to manufacturing, however, they invariably result in requests for engineering changes that would improve costs, tools, methods, and machining.

Unfortunately, changes requested at this late date cannot be easily granted. Product introduction dates are too close. Thousands of design hours have already been expended. Die models have been made; machine tools with long delivery ordered; facilities and procuring arrangements settled; and hosts of other tooling commitments made.

When plastic models are used though, it's a dif-

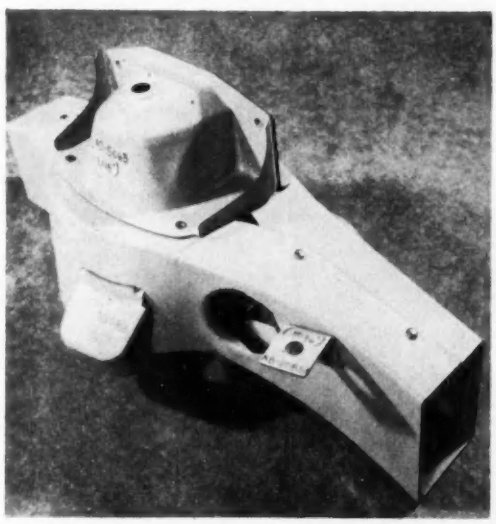
Engineering Joys

Wallace A. Stanley, Manufacturing Engineering Staff, Ford Motor Co.

Based on paper, "Plastic Prototypes Revolutionize Preparation for Manufacture" presented at SAE Summer Meeting, Atlantic City, June 3, 1952.

With plastic models, you see . . .

this . . . **instead of this.**



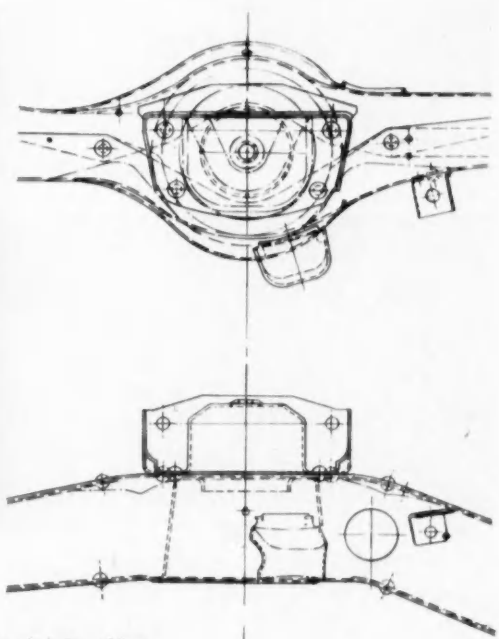


Fig. 1—Plastic models replace thinking-on-paper designing with a see-it-in-the-flesh approach. They make it possible to "see" designs instantly

ferent story. They can be turned out as fast as ideas or designs are presented. This gives shop men a chance to "see" designs and spot undesirable features right at the outset. Welding men can state whether the design lends itself to accessibility of welding tools and good welding practice. Stamping experts can foretell exact difficulties with stampings involved. (See Fig. 3.) Tool engineers can visualize the types of tools and fixtures that will be needed. Materials handling men can handle actual parts and envision the equipment necessary for handling them.

With plastic, it's not only easy but takes little time to rework a design to incorporate the suggestions and counter proposals of manufacturing engineers.

An example of the short alteration time possible is demonstrated by this incident. At 11 o'clock one morning, several changes were suggested in the design of a 10-part assembly. The plastic assembly was sent back to the plastic model shop where it was promptly reworked, reassembled, and resubmitted by 3:30 in the afternoon of the same day. Within 10 min of examining the plastic models, the new reworked assembly was accepted. If this were to have been done in steel, it would have required days—if not weeks—to make these alterations.

Therefore, by using plastic study models, specific, dependable decisions can be made quickly, which ordinarily might have required up to several months to make. Not only does this mean that tooling and production programs can get underway sooner, but fewer requests for engineering changes will be submitted to designers later on in the program.

Fig. 2—The switch to plastic models saved Ford about $500,000 in model costs alone during the first few months of the plastic model shop's existence

Spark Production Programs

Once basic product design is determined, manufacturing engineering can begin. Plastic prototype duplicates can be easily made and sent to processing and tooling engineers, and other interested parties. (See Fig. 4.)

The value of having plastic prototype parts early in the program for processing is almost incalculable. Process engineers are able to visualize clearly all needed manufacturing operations and their sequence. (See Fig. 5.) It's possible to see where several operations can be combined, others dropped. Plastic models show the way to more standardization, either with other parts or with machines and tools used for production of other parts. They also show how to balance operations in time cycles. In one dramatic example, full-size sections in plastic revealed exact needs for welding gun accessibility, what guns should be used, exact location of spot pattern, and time to do all the operations.

Plastic prototypes reach their peak of usefulness,

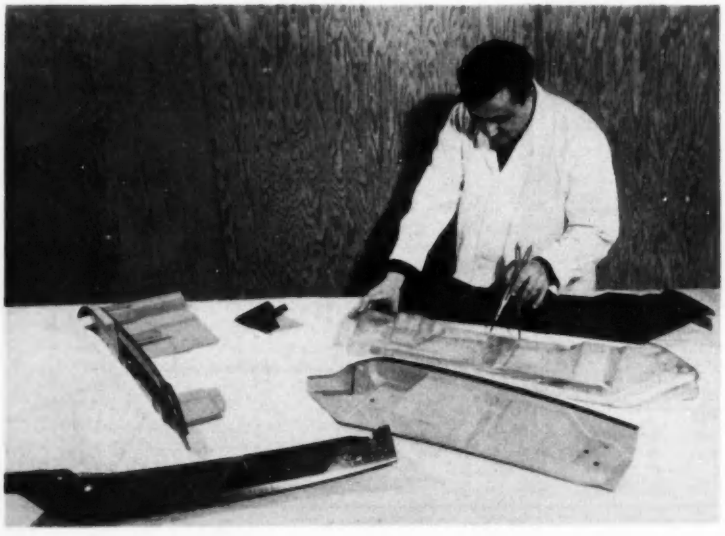


Fig. 3—Plastic study models showed that the proposed design of the three pieces on left would involve extremely difficult, complex stamping. The counter proposal of one-piece design on the right permitted simple press operation

however, as tooling-up aids. Since product design has already been worked out to everyone's satisfaction, tooling can be done with little fear of major design changes later on. Plastic models, then by serving as substitutes for the real thing, give the green light to a majority of tool projects. In the process they save thousands of hours of tool and fixture design and construction time.

In designing and building dies, for example, a plastic model permits a die expert to physically tip the part until he can establish the best draw dip for balancing out the draw of the metal. He can see where to place binder rings and inserts, how many die operations will be required, and where to establish main casting limits. Patterns can be released for casting and rough machining long before final die surfaces are detailed.

Further, plastic parts can be formed or reworked into any progressive stage for the corresponding dies. For example, the die designer could have one for the first draw, one for the second draw, and one for the final form. Or he could have them represent the blank design, cam operation, piercing, restriking, rolling and flanging or any of the scores of other die operations.

Plastic parts can, if required, be made so perfect and accurate that they can be used for designing and constructing checking fixtures. Checking fixtures themselves can be made of special plastics that offer glass-smooth surfaces, true dimensional stability, and the toughness of heat-treated steels.

Plastic prototype parts and assemblies are a boon to jig and fixture men, too. Each part can be dismantled from the assembly for study of positioning, sequence of assembly, locating, clamping, operating time, checking, and all other operations and motions needed to complete parts and assemblies in jigs and fixtures.

Materials handling engineers like plastic models because they permit them to prepare special parts handling equipment months ahead of time. They can position their assemblies; check parts for palletization; determine railroad car dunnage and special racks, boxing or crating needs; and engineer many other preparatory material handling responsibilities.

Similarly, machining experts obtain tremendous benefits from having plastic parts as substitutes for real castings and forgings. They, too, can see the part in all its aspects. This enables them to visualize every machining operation, positioning of parts, inspections, various stations and types of machines required, degree of interchangeability with other machining operations, and hosts of other considerations.

The purchasing department can use plastic models to get more realistic quotations. When people deal strictly with prints, they always add extras to tools and machines to allow for oversights and intangibles. With models though, negotiations can be made confidently because both buyer and vendor are talking about the same thing and can "see" all the problems.

Cut Man-Hours

Models save man-hours all the way down the line from the drafting board to final production of the finished product. Just as thousands of hours are saved in tooling-up for production, so are many hours of drafting and illustrating time saved.

Fig. 4—Easily-duplicated plastic prototypes are sent early in the product development program to different groups in engineering and manufacturing. This gives them a chance to get their programs underway sooner

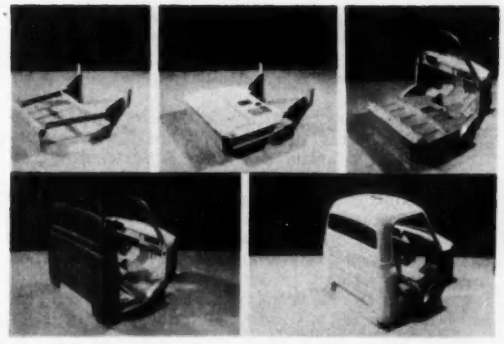


Fig. 5—Plastic prototype study models permit process engineers to experiment with different sequences of assembly

Where previously it has been impossible to take large clay models of accepted designs to drafting boards for detailers to follow, this can be done with light, easy-to-handle plastic models. Used in this fashion, they become tremendous time-savers because they give draftsmen a chance to see the objects which they are detailing.

Thousands of illustrating man-hours can be saved, too. Manufacturing illustrations of parts and assemblies in perspective are usually made on master perspective grid. This takes a lot of time. Plastic models, however, can be photographed and printed directly on cloth or vellum where additional data can be added before making prints for distribution.

(Paper on which this abridgment is based is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members, 50¢ to nonmembers.)

Truck and Bus Engines Must Have

If economy is to be satisfactory and temperature of engine metal is to be held at its proper point—so said participants in SAE Summer Meeting Round Table. Pros and cons of the four basic devices used for controlling water temperature were also discussed.

ENGINE temperatures must be controlled, it was agreed, in order to get the utmost economy as well as to maintain the metal temperatures of the engine at the proper point. Water was considered the most economical liquid to use, from the standpoints of economy, availability, and specific heat. Since water is the most universally accepted coolant, it is desirable to cool the liquid-cooled engines somewhere below 212 F unless, of course, a pressure cap is employed.

There are four basic devices for controlling engine temperatures, namely, shutters, fans, thermostats, and radiators. The yardstick for cooling system performance is the amount of heat that is to be dissipated in maintaining a certain engine water temperature in a given air temperature with fixed fan and space specifications. It was also decided that it was relatively simple to calculate the cooling capacity required, but that there were many factors influencing actual performance and tending to make it deviate from calculated performance.

Air recirculation must be watched closely, pump cavitation must be avoided, fan restrictions minimized, and belt slippage eliminated, so that no appreciable deviation from calculated performance is obtained.

Basically, the pressure cap raises the pressure of a system, which in turn raises the boiling point of the liquid. Other items that, it was agreed, are affected by the pressure cap are: a reduction of evaporation losses, the water flow of some pumps is increased, it allows for regaining some of the temperature loss due to altitude, cuts down on the after-boil, and reduces the air suction at the pump. (Pumps that have an entry velocity of below 10 to 15 fps are comparatively free of cavitation.)

However, a pressure cap will affect certain types of thermostats by causing them to open at a higher temperature.

Antifreeze solutions, because their specific heat is different from that of water, would theoretically reduce somewhat the cooling efficiency of the radiator, but, on the other hand, the heat from the engine usually is not transmitted as rapidly into the antifreeze.

A report on one series of tests indicated that alcohol usually gave a lower temperature than water, while some of the glycols actually gave a higher temperature than water, this temperature being measured in the engine head. Detail conditions under which these tests were run were not discussed. Whenever permanent antifreeze is used, it is very important that the hoses be checked carefully, and preferably replaced with new hoses.

Further discussion disclosed that baffles in the top tank as well as the use of an expansion tank considerably reduce the aeration, surging, and turbulence in the top tank, which, in many cases, does not allow the air to get out of the cooling system, and the air is pulled back into the pump and sent through the engine, thus resulting in hot spots and a loss in the efficiency that comes with uniform engine cooling.

Also disclosed was that spark timing has been known to affect cooling up to 15%.

The temperature differential between the liquid temperature of the engine and the air temperature would decrease about 1 deg for each 10 deg change in air temperature. Therefore, if units are tested over a wide range of temperatures, this item must be taken into consideration.

A general discussion of fans and fan shrouding followed. It was pointed out that, in many cases, the efficiency of the fan can be substantially improved by better shrouding. It was pointed out that present construction of vehicles usually makes necessary a ¾-in. larger fan shroud opening than the fan size. If the clearance between shrouds and fans were cut down from ¾-in. to ¼-in., there would be approximately a 20% saving in horsepower, and the fan would still deliver the same amount of air. A flat area or ring for the fan to run in will appreciably help the performance of the fan.

Continued discussion indicated that fans on present installations sometimes run as low as 15% efficient. In many cases, it has been possible to bring these fans up to an efficiency of almost 50% by minimizing clearance between fan and shrouding to 1/16–⅛ in. Close clearances of this type would not be too practical or conceivable at the present time, and the only suggestion in overcoming this difficulty was that the fan be mounted on to the shroud, which, in turn, would be mounted on to the radiator or unit. This provides some complications in belt driving the fan from a usually rub-

Water-Temperature Control

E. H. Panthofer, Chief Engineer, Perfex Corp.

Secretary's report of round-table discussion on, "Water-Temperature Control in Truck and Bus Engines," held at SAE Summer Meeting, Atlantic City, June 3, 1952.

ber-mounted engine and additional structural support members.

Other items very much affecting the fan are the distance from the back of the fan to the engine block and the total restriction of the system. Other space limitations of equipment placed around the fan as well as recirculation of the air must definitely be stressed. The shroud should be so placed that the fan is half in and half out of the shroud. This rule of thumb applies to both sucker and blower fans. It is also essential to be sure that the temperature of the air that the fan handles is considered. Many of the fan rated curves are rated at 70 F, and sometimes the allowance for air rise through the radiator, which is actually the air the fan must handle, is not taken into consideration.

There was considerable discussion about the cooling to be provided for taking care of torque converters. Here, in general, it was agreed that each condition under which the torque converter operates must be considered and, again, the heat to be removed to keep temperatures within certain limitations must be considered, and will determine the amount of cooling required. Many past applications provided cooling up to usually a maximum of 30% of the horsepower handled by the torque converter.

The water flow should be of sufficient quantity to meet conditions for which the engine is designed and provide enough flow for maximum radiator efficiency.

Generally speaking, there are three types of thermostats employed on engines: the bellows type, Vernatherm, and the bimetal type.

The thermostats should be designed so that the flow through the thermostat in the open position

Large panel of experts that led the discussion on coolant-temperature control for truck and bus engines consisted of (left to right, above): W. M. May, Mack Mfg. Corp.; Roger Birdsell, Yates-American Machine Co.; F. B. Herz, Long Mfg. Division, Borg-Warner Corp.; A. B. Arnold, Modine Mfg. Co.; W. L. Walton, Young Radiator Co.; and (below) H. L. Rittenhouse (leader), Euclid Road Machinery Co.; E. H. Panthofer (secretary), Perfex Corp; R. F. Sheppard, GMC Truck & Coach Division; and L. A. Zwicker, Harrison Radiator Division, GMC

gives the least amount of restriction to the flow, and the bypass from the thermostat should take into consideration the job it has to do on the engine as well as the flow characteristics of the thermostat. Usually, approximately 30 to 40% of the total water flow is bypassed. Care should be taken when using a bellows-type thermostat with a pressure cap, since the thermostat opening temperature increases approximately 2-3 deg with each pound of pressure. It was also pointed out that one way to overcome this condition is to put in a lower-temperature thermostat. The Vernatherm and bimetal type of thermostats are not affected by pressure, and operate directly on temperature.

The thermostat in the closed or semi-closed position functions as a heat regulating mechanism of the engine during the lower-temperature period. At the higher temperature it completely opens and allows the radiator to function as the heat regulating mechanism. Both of these can be supplemented by shutters and adjustable or automatic fans.

The discussion proceeded with emphasis on the three types of automatic fans composed of the variable-pitch fans, the on-off clutch fans, and the on-off eddy-current fans. Care must be exercised to make sure that the fans fail in a safe position, that is, if the automatic mechanism goes out, the fan should become permanently engaged so that it can perform a cooling job and not allow the engine to overheat. The reception of these automatic fans in the field has been very good; however, the price and horsepower saving will be the major determinants of their popularity.

It was pointed out that some of the heavier trucks in the industry seem to be going toward the cast-iron or bolted type of radiators, with removable tanks to allow for better internal cleaning of the radiator core and for a more substantial and rugged structure around the radiator core. It was, however, pointed out that a removable tank type of radiator is more expensive than a soldered brass tank radiator, but extreme care must be taken to secure proper mountings and support for the sheet-metal type of radiator. The equipment builder, therefore, must evaluate ruggedness, durability, replaceability, ease of cleaning, and mounting expense in order to evaluate the type of unit most desirable for his application.

Airborne Equipment . . .

. . . for engineering construction must have low weight and high performance. Over a dozen pieces approach the performance of their standard Army counterparts.

BASED ON PAPER BY **R. G. Alexander**

Engineer Research and Development Laboratories, Engineer Corps, Fort Belvoir, Va.

CONSTRUCTION equipment which is to be airborne must not exceed 16,000 lb, or have a cross section greater than 8×8 ft. And if it is to be dropped from the air the allowable height must be reduced by 18 in. to accommodate special shock absorbing gear, a pallet for mounting, and multiple roller conveyors for getting the equipment in and out of the plane.

To get the performance out of a 16,000 lb tractor equal to that of a standard 32,000 lb one required solving many special problems. Weight is an inherent requirement and is designed into crawler and rubber tired tractors and cranes. Bulldozer performance is measured by ability to push or develop drawbar pull which is directly proportional to weight on the driving wheels or tracks. How to get performance with half the usual weight was, then, the critical design problem.

In order to employ the standard 100 hp engine, higher operating speeds had to be used and operators found they could bulldoze in higher gears. Weight reduction was accomplished by various means. High tensile steel and reduced sections were used in blades and then, when blade penetration was hindered by light construction, scarifier teeth were added to the rear of the blade to use in reverse scarifying to loosen the soil. Skeleton construction, doing away with nonessential guards and accessories, and use of parts intended for tractors of similar weight but half the horsepower, helped to reduce weight. After delivery, increased drawbar pull and higher lifting capacities were gained by installing ballast boxes for filling with sand or dirt to substitute for vital weight.

A life of 500 hours was thought to be acceptable for such a light, high powered tractor, but tests now indicate that life between overhauls may run as high as 1000 to 1500 hours, even though a durability equal to standard equipment is neither expected nor needed.

One 100 hp tractor dozer, a 6 cu yd towed scraper, and a 14,500 lb motor grader have been dropped successfully. Other items in the airborne family are: air compressors, cranes, rock crushers, rollers, tractor saws, bottom dump wagons, crawler and rubber tired tractors with bucket loaders. Though performance does not match that of standard Army counterpart equipment in every respect, it does approach, and in some special applications actually exceed, the standard equipment. (Paper, "Airborne Construction Equipment," was presented at SAE National Tractor Meeting, Milwaukee, Sept. 9, 1952. It is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members; 50¢ to nonmembers.)

Proposed Amendments to the SAE Constitution

THE FOLLOWING proposed amendments to the SAE Constitution are being submitted to the voting members of the Society, "at least sixty days before the next Annual Business Meeting . . ." in accordance with C-54 of the Society's Constitution.

These proposed amendments are the result of a review of the Constitution undertaken by the Constitution Committee at the request of the Council. The recommendations have been endorsed by the Council.

The explanations of the reasons for proposed amendments are quoted from the report of the Constitution Committee.

As required by the Constitution, the proposed amendments will be presented for discussion and final amendment at the Annual Meeting Business Meeting; and, if at that time twenty votes are cast in favor of such submission, the proposed amendments shall subsequently be submitted by letter ballot to all members entitled to vote.

Proposed Amendments

NOTE—Proposed deletions from the Constitution are crossed out; proposed additions are underscored.

C5—The membership of the Society shall consist of Honorary Members, Members, Associates, and Juniors, ~~Service Members and Foreign Members.~~

Explanation: This change would carry out the recommendation of the Membership Committee Executive Committee to discontinue Service Member and Foreign Member grades. In making this recommendation, the Membership Committee Executive Committee stated: "The original purpose of Service Member and Foreign Member classifications of SAE membership was to extend to those members in Government employ and to those residing overseas a reduction in fees and dues.

"Inasmuch as the differential in dues and fees which these two grades of membership enjoyed has been discontinued there appears to be no need to continue these grades. (Dues change was effected in 1948)

"The technical qualifications required for these two grades are the same as for Member grade of membership. Currently, Service Members have all the privileges extended to those who hold Member grade. Foreign Members are not eligible to vote or hold office.

"The Membership Committee Executive Committee further recommends that if the Society's Constitution and By-Laws are so amended, that the necessary action be taken to confer Member grade of membership to all members holding Service Member or Foreign Member grades of membership and to present these members with new certificates.

"If Foreign Members are transferred to Member grade of membership, they would become voting members of the Society. There would be no change in privileges for Service Members.

"As of December 31, 1951, the Society's membership included 208 Service Members and 510 Foreign Members."

C6—(first sentence) Only ~~Members, Service Members~~ and Honorary Members are entitled to hold office in the parent Society; and to vote on questions arising at any Business Meeting of the Society or which may be submitted for letter ballot, and on Constitutional amendments, and for officers and Councilors of the Society, for delegates-at-large to the Annual Nominating Committee and for members of Activity Nominating Committees.

Explanation: Same as explanation for proposed change in C5.

C8—Member grade shall be composed of persons 26 years of age or over, who by previous technical training or experience or by present occupation are qualified to ~~act as designers or constructors of~~ develop, design or supervise construction of complete automotive apparatus or any of its ~~their~~ important component parts; or to exercise responsible technical supervision of the selection, research, development, production, processing or application of materials used in ~~germane to~~ the construction or utilization of automotive apparatus; or to take responsible charge of automotive engineering work, including operation or maintenance; or to impart technical instruction in the development, design, construction and utilization of automotive apparatus; or who by reason of distinguished service or noteworthy accomplishment would, in the discretion of the Council, appear to be desirable additions to this grade.

~~Service Member grade shall be composed of persons 26 years of age or over, engaged exclusively by the United States Government, the qualifications for this grade being the same as those for Member grade.~~

~~Foreign Member grade shall be composed of persons 26 years of age or over, resident in countries other than the United States, Canada, Mexico or Cuba. The qualifications for this grade shall be the same as those for Member grade.~~

~~A Member who has become eligible for either the Service Member grade or the Foreign Member grade, may upon written request be transferred to such grade and thereafter, beginning with the next fiscal period, shall pay the annual dues for said grade.~~

Explanation: The amendment to the first paragraph of C8 is proposed for purposes of clarification at the request of the Membership Grading Committee. The Committee's request was to the effect that consideration be given to amending C8 to include specifically persons who hold or have held responsible positions as research men, chemists, physicists, metallurgists or other positions utilizing the applied sciences in automobile, aircraft, tractor, petroleum and related industries.

The Membership Grading Committee in the past has interpreted C8 to include persons having qualifications as mentioned above and the Council has approved recommendations based upon this interpretation. The Committee feels that the proposed amendment is important for the guidance of future Membership Grading Committees and Councils and for the information of prospective members.

The Constitution Committee felt that rather than list titles, it was preferable to define the functions or services performed by the applicants to be covered by the amendment.

The deletion of the 2nd, 3rd and 4th paragraphs is proposed to eliminate reference to Service and Foreign Members.

C10—Junior grade shall be composed of persons who at the time of election

to the SAE Constitution

are under thirty-three years of age and qualified, by education or experience, or both, to fill subordinate engineering positions in the automotive or allied industries, ~~, or who are regularly enrolled students at or graduates of a technical school.~~ A Junior member may upon reaching the age of twenty-six and shall upon reaching the age of thirty-three be transferred to Member or Associate grade in accordance with the decision of the Council as to which grade his qualifications entitle him.

Explanation: The Council has recommended amendment to eliminate from the qualifications for Junior grade that of attendance at a technical school. Additional change in language is intended as a clarification.

C11—The rights and privileges of every ~~Honorary Member, Member, Associate, Junior, Service Member and Foreign Member,~~ member shall be personal to himself and shall not be transferable by his own act or by operation of law, except by the use of proxies as provided in section C6.

Explanation: To delete reference to Service Member and Foreign Member and for simplification.

C13—All original applications for election to membership ~~the grade of Member, Associate, Junior, Service Member or Foreign Member,~~ shall be presented to the Council, which shall consider and act upon each application, electing each applicant to the grade of membership to which, in its judgment, his qualifications entitle him. Two negative votes shall defeat ~~an~~ the election of an applicant.

Explanation: To delete reference to Service Member and Foreign Member; for simplification and clarification.

C15—~~Each member elected,~~ Excepting Honorary Members elected under C12 and ~~excepting~~ life members ~~elected~~ admitted under the provisions of C18 and C19, each member elected shall ~~pay initiation fee and current dues, or, with the approval of the Council, installments thereof,~~ make payment in accordance with currently effective schedules of dues and initiation fees before becoming entitled to the rights and privileges of membership. If payments are not made in accordance with these requirements within three months after notice of election, the election becomes void.

Explanation: This amendment is proposed for purposes of clarification.

In order to make it easier for Enrolled Students to become members of the Society, the Council voted some time ago to eliminate the initiation fee for Enrolled Students who apply for membership prior to the completion of their post-collegiate year of Enrollment, provided that they have had at least one full year of Enrollment.

There is a possibility that section C15 might be interpreted literally to mean that each member elected, except Honorary and Life Members, must pay an initiation fee. Under this interpretation the Council will not have the power to make the exception for Enrolled Students described above.

With the proposed amendment it is believed that this question could not be raised. Section C16 empowers the Council to set up a schedule of initiation fees and there does not appear to be anything in it which would prevent the Council's adopting a schedule not requiring an initiation fee for a certain class of applicant, such as the Enrolled Students mentioned.

C16 and C17 provide for the payment of dues and initiation fees in installments. Hence, the Council can cover the method of payment on the schedule.

Inasmuch as C19 provides for the awarding of life membership to Past Presidents, the Constitution Committee feels that reference to this paragraph should be included as an additional exception.

C18—The Council shall have the power, by letter ballot, to admit to life membership, without the payment of a life membership fee, any person who, for a long term of years, has been a member ~~Member, Service Member, Foreign Member or an Associate,~~ when, for special reasons, such procedure would, in its judgment, promote the best interests of the Society, provided that notice of such proposed action shall have been given at a previous meeting of the Council. One dissenting vote shall defeat such admission.

Explanation: To delete reference to Service Member and Foreign Member and for simplification.

C20—Any member, ~~Member, Associate, Junior, Service Member, or Foreign Member,~~ who is delinquent in the payment of annual dues for three months, shall not be entitled to receive any publications or other services of the Society until such dues are paid. Any voting member, ~~Member or Service Member,~~ who is delinquent in the payment of annual dues for three months, shall not be entitled to vote or hold office as provided in section C6, or to serve on Annual, Professional Activity or Special Nominating Committees until such dues are paid. Any member ~~Member, Associate, Junior, Service Member, or Foreign Member~~ who shall leave dues unpaid for one year shall, in the discretion of the Council, cease to have any further rights in the Society and be stricken from the rolls of membership. The resignation of a member can be accepted only by vote of the Council.

Explanation: To delete reference to Service Member and Foreign Mem-

ber and for simplification. Wherever practical, the Constitution Committee recommends using the term "voting member" in place of "Member" (initial capital) to indicate a member entitled to vote.

C21—The Council may temporarily suspend the payment of dues by a member of any grade whose circumstances have become such as to make it a hardship for him to pay the dues, and under similar circumstances may waive the whole or part of dues in arrears. Such action shall be taken only upon submission of evidence satisfactory to the Council that the action is for the best interests of the Society. Any member ~~Members~~ whose dues have been suspended shall have Reserve Status and during the period of such suspension shall not be entitled to receive the publications or other services of the Society, or to vote or hold office as provided in section C6, or to serve on Annual, Professional Activity or Special Nominating Committees.

Explanation: The sentence it is proposed to amend now begins with "Members" with a capital initial. Inasmuch as the word "member" with a capital initial refers to voting members throughout the Constitution, this editorial change is proposed to make it clear that the amended sentence applies to all members regardless of grade.

C27—The Council shall present at the Annual Business Meeting of the Society a report, verified by the President ~~or~~ and Treasurer or by a majority of the members of the Council, showing the whole amount of real and personal property owned by the Society, where located, and where and how invested, and the amount and nature of the property acquired during the year immediately preceding the date of the report, and the manner of the acquisition; the amount applied, appropriated or expended during the year immediately preceding such date, and the purposes, objects or persons to or for which such applications, appropriations, or expenditures have been made; also the names and places of residence of the persons who have been admitted into membership in the Society during the last year; which report shall be filed with the records of the Society, and an abstract thereof shall be entered in the minutes of the proceedings of the Annual Business Meeting.

Explanation: "Business" inserted for clarification. "Or" changed to "and" to conform with requirements of New York State laws of incorporation.

C43—A ~~Special~~ professional activity may, in the discretion of the Council, be recognized by authorizing the establishment of a committee of voting members to represent the members of the Society interested in the activity, for purposes which are in harmony with the object of the Society. Not less than 80 percent of the members of a committee so recognized shall be voting members of the Society. Such an activity so recognized shall be known as a Professional Activity; and when so recognized shall be listed in the By-Laws. It shall have such powers and act under such rules and regulations as the Council may from time to time prescribe.

Each Professional Activity so recognized shall be represented on the Council of the Society by a duly elected Vice-President, who shall be Chairman of the Committee of the Professional Activity he represents.

Explanation: Proposed revision conforms to the recommendation of the Council that (a) Juniors and Associates be permitted to serve on Professional Activity Committees and (b) voting control of the Activity Committees be retained by the voting members.

C45—The Past-Presidents of the Society shall constitute the Past-Presidents' Advisory Committee. This Committee shall meet once during the Annual Meeting and at such other times and places as it may elect. This Committee shall provide for its own organization. The Committee may consider any matter referred to it by the Council, or any other matter which in its opinion concerns the interests of the Society. The Committee may report its recommendations directly to the Council, or directly to the membership of the Society when such recommendations have the approval of a majority of ~~its~~ the full membership of the committee.

Explanation: For purposes of clarification as suggested by a member on his ballot on 1948 amendments to SAE Constitution.

C47—The Council may at any time, in its discretion, remove any or all members of any committee, except of an Annual Nominating Committee, Professional Activity Nominating Committee, ~~or~~ Special Nominating Committee, or the Past-Presidents' Advisory Committee, and the vacancy, arising from this or from any other cause, shall be filled by appointment by the President.

Explanation: For purposes of clarification, as suggested by a member on his ballot on 1948 amendments to SAE Constitution.

Differs on Design Agrees on Safety

. . . that's how industry views *Power Steering*

W. A. Hunter, Project Engineer, Chrysler Corp.

Report on Round Table on Power Steering for Passenger Cars, held at SAE Summer Meeting, Atlantic City, June 4, 1952, under auspices of SAE Passenger Car Activity Committee.

EACH vehicle maker has just a little different idea of what power steering should provide. That's why several type systems are being considered—such as the integral unit in some cases and the linkage booster (where the power unit supplements manual steering) in others. But despite these differences, all agree power steering in general enhances driving safety.

A great deal has been said about full power steering on the one hand, and power steering only when you need it on the other. In other words, in some power steering systems, part of the effort required to handle a car is supplied manually and the balance hydraulically, at all times. In other systems, the driver supplies all of the effort required up to a certain point; beyond that he is assisted by the power unit.

To derive the full benefit of power steering, the power should be available throughout the whole range. Steering a car in traffic or on the highway requires precision. If you wanted to make an accurate measurement with a micrometer, you would not want the spindle tightened. You would want it free so that you could "feel" the contact with the part being measured. So it is with precision steering.

Thus, if we reduce the effort of steering in traffic or highway operation, we will have more precision and be more relaxed. Another and very important reason for having low effort for straight-ahead driving is that with a manual gear it requires from 3 to 5 lb at the rim of the steering wheel to hold a car straight on the average crowned road. While this is not a lot, on a long drive it will tire the arm and back muscles and develop driver fatigue.

Now, the second production power steering system to be offered the public is one in which the control system calls for power only after a certain force is required to control the car. In other words, the control valves are spring centered, and power is not made available until these spring forces are exceeded. Advocates of this type steering claim that it gives the driver a more "natural" feel and eliminates the possibility of over-steering.

Advocates of the full time power steering system claim:

> Power steering is revolutionary and offers many benefits which can not be obtained by retaining the "natural operation." Power steering more than any other mechanism can be designed so as to obtain any combination of the variables of force and motion which the senses perceive. The proper combination of these variables must be experienced by the public before it can be appreciated.
>
> Power steering in any form is so vastly superior to manual steering that it is accepted even though only a fraction of the possible benefits may be present. Accordingly, it is our duty to provide the public with all the benefits of power steering in the right combination. Full-time power steering provides these benefits.
>
> Maximum reduction in steering effort and fatigue can be obtained under all conditions. The ability to hold the car "on course" against the effects of ruts, bumps, road crown, crosswinds, etc., is improved through the use of power all the time. There is less tendency for jerkiness and uneven feel.

Stability Unchanged

There has been some interest in the effect of power steering on the directional stability of a car. Actually there is no effect on directional stability under normal conditions. There may be a slight tendency to drift in one direction, because of control valve leakage and equal pressures applied to

unequal piston areas on some systems; but this is easily compensated and does not appear objectionable.

If the road is rough, or if driving on the shoulders becomes more frequent, the directional stability is fortunately improved. That's because of the high damping of wheel movement inherent in power boost systems.

We are all very ready to admit the advantages of power steering with relation to the ease of parking and general handling of the car; what about the safety angle? To what extent and in what manner does power steering increase the safety of the automobile?

No Remedy for Poor Driving

First of all, it should be made plain that power steering has no miracles to offer for the salvation of the careless driver, the unskilled driver, or the stupid driver. We are careful, skilled, alert. When we get into trouble, it is the other fellow's fault. Nevertheless, we all do occasionally hear the rustle of angel's wings when we are driving.

The safety features of power steering contribute heavily to its value.

The question is raised as to the hazards of a sudden, unexpected loss of power. It is disconcerting, and leaves the driver in the position of making the best of his manual reserve which is provided. As compared to other driving emergencies which can and do arise, the hazard is considerably less and its occurrence extremely infrequent.

Power steering gives greater degree of control in case of sudden tire failure. This encouraging fact does not make the safety tire less desirable. The driver who insisted on safety tires will also insist on power steering because he likes to have a favorable percentage on his side.

Power steering provides better control on rough terrain. In emergencies, cars must depart from the road. The fact is that drivers should be trained to do so, rather than to accept a head-on collision. The chances of a car regaining the road over a con-

Steering Engineering Lexicon

Steering effort:

Used to describe how hard the driver must turn or pull on the steering wheel to steer the car. It is usually expressed in terms of pounds pull at the rim of the steering wheel. Since it sometimes varies with different positions of the wheel, it is often plotted against steering wheel rotation in the form of a curve or graph.

Steering ratio:

The overall ratio expressing how far the steering wheel must be turned to obtain a certain amount of turning of the steering knuckles. We believe it can be stated most simply as the ratio of total degrees of steering wheel travel, divided by total degrees of steering knuckle travel (with the value of knuckle travel being expressed as the average of the travels of the right and left knuckles).

"Natural operation":

The ease, comfort, and rapidity with which the new driver becomes accustomed to a new device or a new method of controlling an automobile.

Responsiveness:

Ability of the car and its steering system to follow the desires of the driver as he expresses them by movement of the steering wheel. It is the property which facilitates the dodging of obstacles at both high and low speeds, recovery from skids, and, in general, the making of all maneuvers which require quick and accurate steering.

Feel of the road:

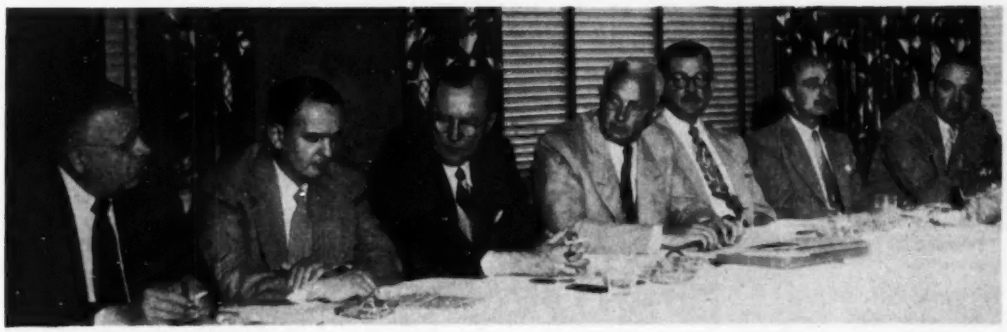
The ability of the car and the steering system to provide the driver with the feel of the road surface and the knowledge that the car is changing course, whether the driver's eyes are on the road or not—provided his hands are on the wheel.

Returnability:

Tendency of the steering system to return to a "straight ahead" or "centered" position when the car is moving on a straight, level road, and when no force is being exerted on the steering wheel.

Directional stability:

The characteristic that a car and its steering system have when the car will continue to move in any direction the driver wishes it to, with a minimum tendency to wander or to be affected by ruts, uneven road surface, etc. A car which does not have directional stability has sometimes been referred to as a "dumb" car (as compared with a stable car).



New developments often provoke controversial opinions. That's what this panel of specialists on power steering found at the SAE Summer Meeting. These men are (left to right): C. W. Lincoln, chief engineer, Saginaw Steering Division, GMC; T. H. Thomas, chief engineer, Bendix Products Division, Bendix Aviation Corp.; W. K. Creson, vice president in charge of engineering, Ross Gear & Tool Co.; Round Table Leader P. C. Ackerman, chief engineer, laboratories, Chrysler Corp.; C. F. Hammond, vice president in charge of engineering, Gemmer Mfg. Co.; P. H. Pretz, test engineer, Ford Motor Co.; and Secretary W. A. Hunter, project engineer, Chrysler Corp.

siderable pavement shoulder are bettered by power steering. Chuck holes and collisions with minor obstructions can be negotiated with far less chance of loss of control.

The faster steering response which goes with power steering is useful in avoiding major collisions and in recovering from skids. Today's cars are capable of racing speeds; therefore, steering ratios should reflect, to some extent at least, the long experience and usage of the racing game.

Last, but not least, a strong factor in causes of car accidents is driver fatigue. Power steering delays the encroachment of fatigue. It not only measurably lessens the work of the driver, but makes possible the building in of better directional stability. Better directional stability means less mental strain and, therefore, less fatigue on long mileage.

So we can say the safety advantages of power steering on cars appear to supplement, in a most fortunate way, its other features of convenience and ease of operation.

Now, what about the hazards?

There are no actual hazards in power steering systems as they are in use at present, although some questions along this line have been raised, such as:

- What happens if the hydraulic pump should fail?
- Can the car be steered if a steering system oil line should break?
- Does power steering make it easier for a driver to get into "tight spots" from which he cannot readily extricate himself?
- Does the fact that the driver need not hold the steering wheel so tightly detract from his alertness?
- Are the parts of the steering linkage more highly stressed and more apt to fail?

In the case of any failure of the hydraulic system, the driver still has mechanical steering. The required driver effort is much greater, of course, than with the power assist operating, but safe driving is still assured.

Experience of many drivers indicates that there is no tendency to over control in case of an emergency. In fact, all drivers who have been in a "tight spot" have been able to steer out of it more safely because of the fast response and precision steering made possible by the use of power.

Driver fatigue dulls the operator's senses; simply making it difficult to drive does not make the operator more alert.

Due to the elimination of wheel fight, the average stresses in the linkage are higher with hydraulic steering than with manual steering. However, the maximum stress in the linkage occurs when dry parking, and this is the same for both manual and power steering with one possible exception. When the operator attempts to jack the car away from a curb with power steering, higher stresses could be imposed, if it were not for the relief afforded by the system oil pressure relief valve which is set to open at a pressure slightly above dry parking pressures.

The upper limit of overall steering ratios has been established as approximately 30 to 1. Is there a lower limit to which the ratio can be reduced? How low is it reasonable to go? Can we go to 12 to 1, 10 to 1, or is there some band in which it is going to be necessary for us to work?

Since one of the major advantages of power steering is that it frees the designer from the necessity of compromising between desired effort and desired ratio, it is interesting to observe that there isn't very good agreement yet as to what the desired effort and desired ratios might be.

Certainly if power assistance is to reduce effort at high speeds in the same proportion as it reduces effort in parking—and this is substantially what systems now available on cars do—any rapid change from ratios in the 20 to 30 to 1 region to which the public are accustomed may be undesirable. While ratios will gradually fall, limits above at least 12 to 1 will doubtless prevail for some time.

We are learning in the only safe way—that is, through public opinion—just what the average driver thinks of this new unit. Undoubtedly his reaction and comments will definitely indicate the lines along which future development will go.

November

SECTION MEETINGS

Atlanta—Nov. 17

Dinner 7:15 p.m. Modern Front End Suspension.

Baltimore—Nov. 13

Engineers Club. Dinner 7:00 p.m., meeting 8:00 p.m. Inspection tour of Electro-Motive Division Locomotive Overhaul (Diesel) Shops at Halethorp, Maryland. Dinner at Engineers Club. Members and guests transported to shops after dinner and returned after tour.

Buffalo—Nov. 18

Rochester Products Co. Dinner 6:30 p.m., meeting 7:30 p.m. Plant tour through Rochester Products Division, GMC, Rochester, N. Y. Speaker to be announced to present highlights of the plant tour.

Canadian—Nov. 19

Royal York Hotel, Toronto. Dinner 7:00 p.m., meeting 8:00 p.m. The Human Aspect of Industrial Relations—Ralph Presgrave, vice-president, Woods & Gordon, Ltd.

Central Illinois—Nov. 17

Jefferson Hotel. Dinner 6:30 p.m., meeting 7:45 p.m. Recent Developments on Engine Air Filters—S. H. Beach, chief engineer, Donaldson Co., Inc.

Chicago—Nov. 13 and Nov. 17

Nov. 13—Hotel Knickerbocker, Chicago. Dinner 6:45 p.m., meeting 8:00 p.m. Topic—Fuels and Lubricants. SAE President D. P. Barnard. Social Half-Hour 6:15 to 6:45 p.m.

Nov. 17—LaSalle Hotel, South Bend, Indiana. Dinner 6:45 p.m., meeting 8:00 p.m. Industrial Team Play—The Key to Transportation Success—B. R. Jones, Ethyl Corp.

Cleveland—Nov. 10

Tudor Arms Hotel. Dinner 6:30 p.m., meeting 7:30 p.m. Rolling Wheels Gather No Skid—A. C. Gunsaulus, Wheel & Brake Division, Goodyear Aircraft Corp.

Colorado—Nov. 16

Denver Imported Motors. Meeting 8:00 p.m. European Styled Trends—Curt Kircher, president and general manager, Denver Imported Motors. Slides will be shown.

This is not a complete list of all Section Meetings. It includes only those meetings for which we have received sufficient advance notice to permit listing.

Detroit—Nov. 17, Dec. 2, and Dec. 8

Nov. 17—Rackham Educational Memorial Bldg. Dinner 6:30 p.m., meeting 8:00 p.m. Butter and Guns—A Plan for National Defense—John F. Gordon, vice-president, General Motors Corp., also Douglas Roby, national president, A.A.U.

Dec. 2—Junior Group Field Trip through Kaiser-Frazer Corp. Open to members only.

Dec. 8—Dinner meeting to be sponsored by Body Activity.

Indiana—Nov. 13

Marott Hotel, Indianapolis. Dinner 7:00 p.m., meeting 8:00 p.m. New Horizons in Engine Development—E. G. Moeller, Chrysler Corp. Discussion on Chrysler 310 hp stock engine. Social Half-Hour 6:30 p.m.

Kansas City—Nov. 11 and Dec. 9

Nov. 11—912 Walnut Street, Kansas City, Mo. Dinner 7:00 p.m., meeting 8:00 p.m. Dart Truck First 50 Ton Truck—Ralph H. Kress, executive vice-president, Dart Truck Co.

Dec. 9—912 Walnut Street, Kansas City, Mo. Dinner 7:00 p.m., meeting 8:00 p.m. Filtration of Internal Combustion Engines—Jules P. Kovacs, chief engineer, Purlator Products Co.

Metropolitan—Nov. 13

Brass Rail Restaurant, Fifth Avenue between 43rd and 44th Streets. Dinner 6:30 p.m., meeting 7:45 p.m. New Design Requirements Learned from Korean War Aircraft—Col. Harry James Sands, Jr., USAF.

Mid-Continent—Dec. 5

Stillwater, Okla. Meeting 8:00 p.m. Topic will be engine design. This will be a joint meeting with the Oklahoma A & M College Student group.

Mid-Michigan—Nov. 24

Owosso City Club. Dinner 6:30 p.m., meeting 8:00 p.m. Modern Highways—Roy E. Jorgensen, National Highway Users Conference.

Mohawk-Hudson—Nov. 11 and Dec. 2

Nov. 11—Circle Inn, Latham, N. Y. Dinner 6:45 p.m., meeting 8:00 p.m. Power Steering—Francis W. Davis, consulting engineer.

Dec. 2—Locomotive Club, Schenectady. Meeting 8:00 p.m. Social evening presentation of Old Timers' Certificates. Film: American Harvest.

Montreal—Nov. 17

Sheraton Hall, Mount Royal Hotel. Dinner-Meeting 6:00 p.m.

Northern California—Nov. 19

El Curtola Restaurant, Oakland. Dinner 6:30 p.m. Valve Gear—John A. Newton, chief engineer, Valve Division, Thompson Products, Inc.

Northwest—Nov. 8 and Dec. 8

Nov. 8—Stewart Hotel. Dinner 6:30 p.m., meeting 7:30 p.m. Field Trip to Kenworth Motors Truck Corp. Wally Brown, project engineer, Kenworth Motor Truck Corp.

Dec. 8—Stewart Hotel. Dinner 6:30 p.m., meeting 7:30 p.m. American Truck Fleet. E. W. Templin, sales manager, Timken Detroit Axle Co.

Philadelphia—Nov. 12

Engineers Club., Philadelphia. Dinner 6:30 p.m., meeting 8:00 p.m. Chrysler K-310—V. M. Exner, advanced styling section, Chrysler Corp.

Pittsburgh—Nov. 25

Webster Hall, Mellon Institute. Dinner 7:00 p.m., meeting 8:00 p.m. Combustion Chamber Deposition and Knock—H. J. Gibson, research supervisor, Ethyl Corp. Paper prepared jointly by H. J. Gibson, C. A. Hall and D. A. Hirschler.

St. Louis—Dec. 9

Gatesworth Hotel. Dinner 7:00 p.m., meeting 8:00 p.m. Designer's Part in Maintenance Costs—J. E. Glidewell, chief engineer, Hall-Scott Motors. Movie to be selected.

Southern California—Nov. 13

Rodger Young Auditorium, 936 W. Washington Blvd., Los Angeles. Dinner 6:30 p.m., meeting 8:00 p.m. Aircraft Cost Reduction—Brig.-Gen. Walter G. Bain, chief of Procurement, Air Materiel Command, Wright-Patterson Air Force Base.

Southern New England—Dec. 4

The Hedges, New Britain, Conn. Dinner 6:45 p.m., meeting 8:00 p.m. The Jet Grows in Connecticut—William P. Gwinn, general manager,

Continued on Page 86

2500 Flock to Los Angeles Aero Meeting

TWENTY-FIVE hundred of the people most directly concerned with producing today's aircraft and engineering tomorrow's took off from all parts of the country and converged on Los Angeles' new Statler Oct. 1–4. The occasion was the SAE National Aeronautic Meeting, Aircraft Production Forum, and Engineering Display—biggest meeting SAE ever held except for recent Annual Meetings.

Over 1100 of those attending were on hand the first day for the 11 Production Forum panel discussions. The others arrived later to participate in the technical sessions—held two at a time on Thursday morning and afternoon and Friday morning and afternoon and singly those evenings and Saturday morning. All 900 tickets were taken for the dinner dance Saturday evening ending the four-day event.

The crowds at first nearly overwhelmed the staff of the two-month old hotel. But they overjoyed Production Forum Chairman B. C. Monesmith and Program Chairman W. C. Heath and their hardworking committees.

The meeting was sponsored by the Aircraft, Aircraft Powerplant, Air Transport, and Production Activities of SAE. They had the cooperation of SAE's eight West Coast Sections as well

General Chairman W. C. Heath (left) beams as SAE President D. P. Barnard congratulates him on fine program he and his committee arranged

"Just to see so many SAE members and guests here makes it worth all the work," these three activity meetings vice-chairmen agree. They are W. C. Lawrence (left) of the SAE Air Transport Activity, A. L. Pomeroy of the SAE Aircraft Powerplant Activity, and F. W. Fink of the SAE Aircraft Activity

as of the Aircraft Industries Association of America, Inc. and the Air Transport Association of America.

Most of the papers presented will appear later in SAE Journal in abridged form. Exceptions will be three confidential papers presented at the Thursday evening session, which was open only to the 700-odd people specially cleared for it by the U. S. Air Force. These three were "Soviet Air Weapons" by Fred Kobernuss of the Air Technical Intelligence Center, "Design Features of the Bell X-5 with Adjustable Wings" by J. A. O'Malley, Jr. and R. J. Woods of Bell Aircraft, and "Flight Experience with Delta Wing Aircraft" by Ralph Bayless of Consolidated Vultee Aircraft.

Flying Faster and Higher

Many of the papers discussed in the open sessions dealt with problems of flying faster and higher. Specialists in various fields pointed out that near-supersonic aircraft are subjected to severe heat from aerodynamic friction as well as from hot engine parts. Such aircraft encounter also the very low temperatures that prevail at high altitudes and polar regions. At the same time, aircraft structures are called upon to withstand ever greater forces and powerplants to give better and better performance. The result is, the meeting indicated, that aircraft designers are turning to new materials, giving more attention to the effects of temperature extremes on systems and accessories, and requiring increasingly rigorous testing of powerplant and airframe.

Because of demands for higher strength at elevated temperatures, steel is threatening to displace aluminum in some applications and titanium is displacing steel in others. Douglas is experimenting with Crucible Steel's Hy-tuf high-tensile steel in landing gear assemblies, catapult hooks, and arresting hooks, C. H. Stevenson of Douglas' El Segundo plant revealed. Results are so good that high-strength steels of this type may even replace aluminum wing spars in supersonic airplanes, he said. Hy-tuf is a ductile, low-alloy steel giving almost the same tensile strength-weight ratio as 75ST aluminum extrusion with a strength of 80,000 psi.

North American Aviation is using the new precipitation hardening steels Armco 17-4PH and 17-7PH and Carnegie-Illinois Stainless W, Gordon Fairbairn disclosed. His company finds that these alloys combine superior corrosion resistance with mechanical strengths comparable to those of highly heat-treated low-alloy steel. Utilization of precipitation hardening steels saves both man-hours and tooling expense, according to Fairbairn.

Aluminum alloys are advancing too, J. A. Nock of Alcoa showed. Among the alloys he discussed was XA78S, which he described as a higher strength 75S-type alloy. The new alloy was said to develop about 10% higher strength than 75S. Formability and resistance to stress-corrosion cracking are not quite so good for the new alloy, however.

For fire walls, titanium is replacing steel. Titanium weighs only two-thirds as much as stainless and can be substituted on a gage-for-gage basis in the temperature range 300–700 F. Substitution of titanium for stainless on 11,500 sq in. of firewall in the DC-7 is saving 64 lb per plane, Douglas' W. E. Kavasch reported. Titanium will not burn through, he said, although ultimately it may have to be replaced because of embrittlement resulting from absorption of oxygen, nitrogen, hydrogen, and carbon at elevated temperatures.

Ceramic coatings on heat-resistant steels are improving their performance significantly. Solaramic processed Type 321 stainless burner liners have given more than 500 hours of satisfactory operation, John V. Long of Solar Aircraft reported.

Unfortunately, there's no such coating for rubber parts, which may be subjected to high temperatures, particularly in very fast planes. Buna-N and similar compounds used for seals in contact with fuel

and for fuel tanks retain good physical properties up to 200 F but at 290 F rapid deterioration may be expected. Julius Jonas made this point in his paper on the effect of aerodynamic heating on fuel systems.

Not all temperature problems with rubber and metals are at the high end, of course. Modern aircraft are expected to function at ambient temperatures of -65 F. But that doesn't mean that every detail part must function at -65 F, warned Northrop's Charles M Miller in his paper on elastomers. Many rubber or rubber-like parts in instruments, cameras, or rocket equipment will always be in heated compartments when called upon to function. There's no need to require such rubber parts to pass a flexibility test at -65 F, he reminded designers.

Bernard Gross of Rohr Aircraft described Chan-O-Seal, a new type of sealant he believes superior to conventional unconfined synthetic rubber fuselage seals. In the application of Chan-O-Seal, he explained, a channel is provided adjacent to the joint. The channel is filled with a non-curing sealant by injection from the outside of the structure through injection ports.

Plastic Enclosures

In the field of transparent plastic enclosures for aircraft, craze resistance as well as heat resistance is a problem in high-speed aircraft. With these problems in mind, aircraft manufacturers have been studying three new types of plastics, G. E. Hughes of Boeing related. They are:

1. Cross-linked acrylic. Rohm and Haas' new 5105XP is of this type. It has good light transmission characteristics and resists deterioration from heat and aging. Mechanical properties are equal or superior to those of the methyl methacrylates now commonly used for enclosures. The 5105XP offers advantages on present aircraft, but aircraft manufacturers feel its heat resistance will be inadequate for future faster aircraft.

2. Polyester materials like Sieraccin 611 and Selectron 44. Outstanding property of the polyester resins is their apparent complete craze resistance. Mechanical and forming characteristics are good, but insufficient thermal resistance will probably limit their use on supersonic aircraft.

3. Polymethyl alphachloroacrylate, known as PMACA. Materials of this type, such as Gafite, show excellent heat resistance, having a heat distortion point of 250 to 270 F. Craze resistance and strength are high also.

PMACA appears to be the likeliest material for enclosures on supersonic aircraft, Hughes opined. But because of the toxicity and handling difficulties of the basic monomer, the supply of PMACA is now insufficient for high production.

At the same session came news of a new thermosetting foamed plastic for making filled-in-place sandwich structures. The new material is Lockfoam, which Lockheed's J. M. Gerschler described. Liquid Lockfoam is poured into the sandwich cavity. Subsequent heating brings about a chemical reaction in which carbon dioxide is generated. The result, on cooling and solidification, is a cellular structure securely bonded to the outer skins. Lockfoam has been used in control surface tabs, experimental

. . . Around the Meeting

After they had seen the eagerness of the crowds that packed the production discussions, the Production Forum Executive Committee laid plans to spread next year's panel meetings over two days instead of just one. The idea is to give people a chance to attend more panels and to have larger rooms available for the panels.

* * *

SAE Council held a meeting during the Aeronautic Meeting, the first in conjunction with the West Coast Aeronautic Meeting in 10 years. The Council approved tentatively plans to hold next year's West Coast Aeronautic Meeting and Aircraft Production Forum Sept. 29 through Oct. 3, again at the Los Angeles Statler.

* * *

Geographically minded men who wandered along by the row of rooms named for the cities where Statler has hotels—like the Dallas Room, the Hartford Room, and the St. Louis Room—wondered about the name of the last room in the series, the "Foy Room." But SAE Journal's genealogical editor uncovered the fact that "Foy" is the name of the family who owned the mansion torn down to make way for the hotel.

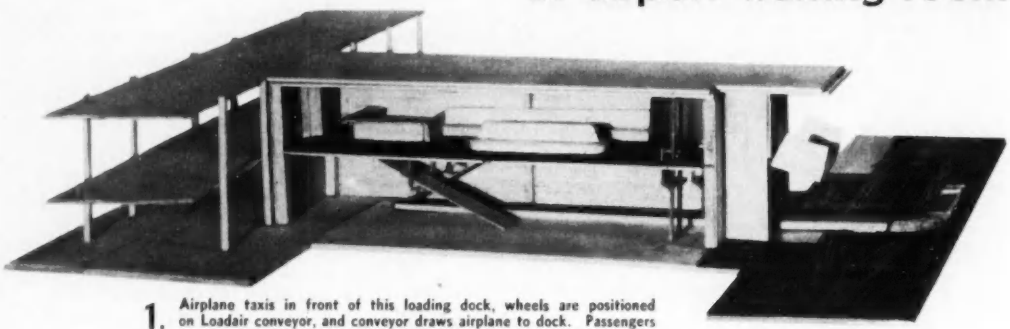
* * *

SAE President D. P. Barnard attended the Aeronautic Meeting, then took off the day after it was over for a 10-day trip to Hawaii, including a visit with SAE Hawaii Section.

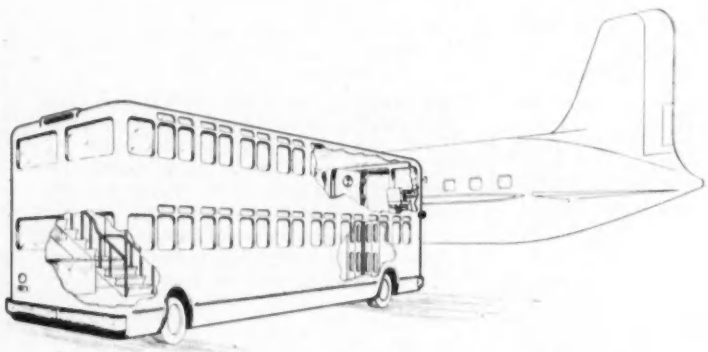
* * *

SAE Past-President Bill Stout and Duke Reynolds "superintended" while a crane operator maneuvered a five-story-high palm tree into a hole dug for it in the landscaped grounds in front of the hotel. Couldn't have done it better themselves, they admitted.

Five ways to speed passengers between or airport waiting room

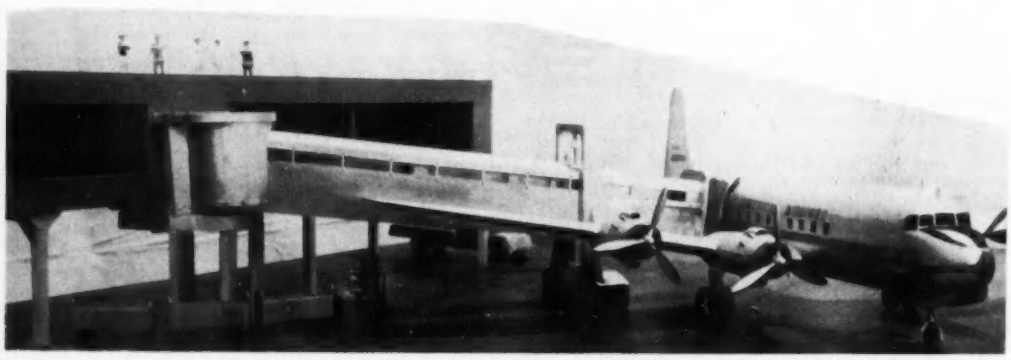


1. Airplane taxis in front of this loading dock, wheels are positioned on Loadair conveyor, and conveyor draws airplane to dock. Passengers use upper level of dock, and freight moves along lower level



2.

Mobile gatehouse transports passengers from airport waiting room to plane ready on runway. It's much cheaper to run the bus between the terminal building and the runway than to taxi the plane that distance



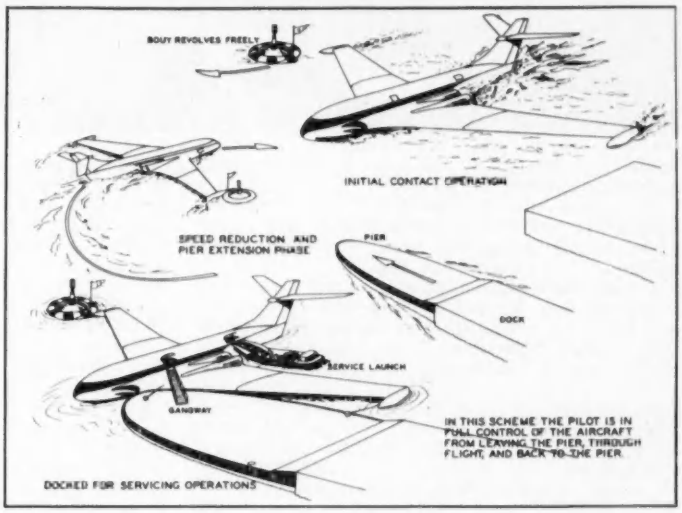
3. Pivoted, extendable passenger loading ramp positions its exit precisely at aircraft doorway. Passengers are protected from weather and need not climb the usual steps up to plane

downtown terminal and plane . . . shown in Aero Meeting papers

by . . . 1. H. W. Anderson, Whiting Corp. 2. E. W. Fuller, American Airlines 3. H. M. Henion, Airways Engineering Corp. 4. E. G. Stout, Consolidated Vultee 5. F. N. Piasecki and L. S. Wigdortchik, Piasecki Helicopter Corp.

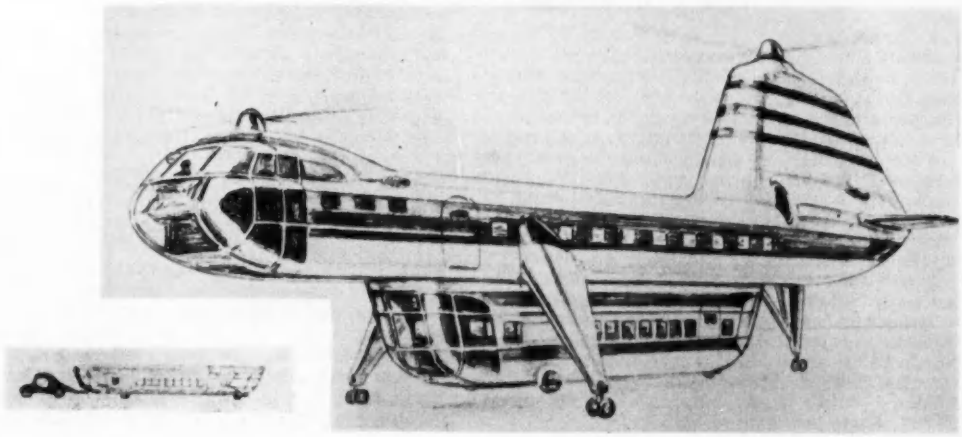
4.

Water-based transport contacts buoy, which swings plane around while pier emerges from dock. Passengers debark down stairway over wing. Idea is that many cities can better accommodate this type of port for water-based craft than additional airport facilities


BOUY REVOLVES FREELY
INITIAL CONTACT OPERATION
SPEED REDUCTION AND PIER EXTENSION PHASE
PIER
DOCK
SERVICE LAUNCH
GANGWAY
IN THIS SCHEME THE PILOT IS IN FULL CONTROL OF THE AIRCRAFT FROM LEAVING THE PIER, THROUGH FLIGHT, AND BACK TO THE PIER.
DOCKED FOR SERVICING OPERATIONS

5.

Pod-type helicopter replaces limousine for transporting passengers from center of large city to its airport. Small truck moves pod around airport, and helicopter proper departs with another pod



J. H. Kasley (left) and J. M. Mergen with the Manly Memorial medals they received from G. W. Newton for the paper on turboprop propellers they presented at last year's West Coast Aeronautic Meeting. They received the medals and certificates at the Friday evening session

radomes, rocket doors, gas tank shockboards, and ailerons, according to Gerschler.

The "radomes" Gerschler mentioned, as the initiated knew, are the plastic housings that protect airborne radar equipment. A six-paper symposium on the subject brought out that:

- Radomes are generally made from glass-fiber-reinforced resin laminates. Large radomes are usually made from two or more layers of reinforced resin separated by some low-dielectric material. Basic steps in the fabrication of the reinforced resin layers are (1) saturating the glass fiber filler material with the resin, (2) laying up this impregnated material in or on the mold, and (3) curing by the application of moderate heat and pressure.
- Sandwich-type radomes of currently used plastic materials are not suited to supersonic aircraft. The limitations lie in the physical and electrical properties of available dielectrics.
- Radomes protecting gun-aiming radar suffer from gun blast. Deleterious effects can be minimized by designing radomes to be small and well rounded. Blast reducers help too.
- Optical characteristics to be considered are the radome's efficiency in transmitting microwave radiation, its reflection of energy both outside and inside, the refraction of waves passing through the radome, and the diffraction occurring because wave length is a large fraction of the diameter of the dish.
- Ice build-ups on radomes impair radar performance. Ethylene glycol spray systems provide reasonably satisfactory de-icing and anti-icing.
- Primary problem in wind tunnel testing of icing equipment is reflection from tunnel walls. It can never be eliminated altogether, and it must be compensated for in considering results of wind tunnel tests.

Those who contributed papers to this symposium on radomes were R. L. Whann and J. A. Sporcic of North American, H. A. Hummel and Al Leipzig of Douglas, E. T. Phillips of Ryan, W. Garcia of Consolidated Vultee, C. A. Gibbons of Northrop, and F. E. Lenherr of Northrop.

Radome icing is, of course, only part of the icing problem. The whole aircraft icing problem was considered in another six-paper symposium. Participants agreed that as long as thrust can be maintained, the modern airplane can cart around an amazing amount of ice—but it shouldn't have to. Myron Tribus of the University of Michigan faculty stated the problem in general terms. C. M. Christenson of United Air Lines and D. M. Patterson of the Air Force explained it from the users' point of view. B. L. Messinger of Lockheed, E. E. Callaghan of NACA, and A. A. Brown of Pratt & Whitney discussed solutions.

Extreme high temperatures around engines continue to be a problem, however, the meeting showed. Turbine engines are difficult to cool sufficiently at low altitudes either at high speeds—where engine temperatures are maximum—or under static conditions—where externally forced convection cooling is lacking. Just as serious are the problems at very high altitudes like 50,000 ft, where the decreased air density destroys the effectiveness of convection cooling and radiant heat transfer must do more of the job, Leonard J. Lyons of Northrop explained. As flight speeds continue to increase into the supersonic regime, the entire flight path becomes a transient problem, he said. Different parts of the installation become critical at different times, and it is necessary to examine each part as the flight conditions change.

High temperature problems are the reason Ralph Kress of Solar gave for Solar's concentration on multi-flap afterburner nozzles instead of the bulb-type nozzles. The latter have better dimensional efficiency, but it is exceedingly hard to make their actuators work, since they must be located inside the hot annular stream of the afterburner. Multi-flap nozzles and their actuators stand up better and, besides, are easy to manufacture.

Kress emphasized, as did William H. Hand of North American in discussing jet-engine exhaust nozzles, that airplane base drag increases as the

annular area between the jet stream and the airframe air stream increases. The discontinuity between airframe and nozzle creates a low pressure area representing a drag on the plane, they explained. This drag and the fairing drag should be balanced against the thrust coefficient obtainable in considering any nozzle, Hand warned.

Design Philosophies Outlined

In discussing pneumatic starters for turbine engines A. K. Forney of the Navy Bureau of Aeronautics outlined the Navy's philosophy on starters for carrier aircraft: "The starter and control valve will be installed in the aircraft. The gas turbine compressor will be considered special equipment not included in aircraft weight empty, but it shall be packaged in such a manner that it can be carried with the aircraft at the option of operating personnel. It is intended that the aircraft carry the compressor on cross-country and ferry flights, and also on staging operations, but that it will be left at the base during combat missions."

British and American philosophies on design of turbine engine controls were contrasted by C. S. Constantino of Wright Aeronautical. The British feel, he related, that the pilot should assume responsibility for the proper operation of the engine. American thinking is that the pilot should be free to devote his undivided attention to flying the airplane.

The more complicated the engine, the more flight testing it requires, according to the symposium held the final morning of the meeting. Steps in the typical flight testing program are:

1. Determining performance of the basic engine —particularly the effects of transient flight conditions, which can not be determined in present ground facilities.
2. Checking engine auxiliaries, such as controls.
3. Testing the afterburner, if any, and its controls.
4. Refining components of the engine and its installation.

All this takes time. The sooner the engine can be flown, the better. That's why planes equipped to serve as flying test beds for new engines are so useful, emphasized M. C. Benedict of Westinghouse, W. E. Stanger of GE, J. R. Steding of Allison, and H. B. Archer of Pratt & Whitney.

It will be three to five years before ground test facilities will be capable of simulating dive and climb conditions, Lt. Col. D. M. Ross of the Wright Air Development Center estimated. However, new altitude simulation chambers now under construction for the military services and NACA will be able to simulate most if not all of the transients at constant altitude, Ross disclosed.

From drop tests of its AJ-1 Navy attack bomber, North American has found that drop tests with two-thirds wing lift yield conservative results, J. W. Gaines and F. V. Wagner reported. Vertical loads would compare more closely with field landings if a wing lift of 1 to 1.2 were used. Drag loads appear to be conservative even if this amount of wing lift were used, since they do not appear to be critically affected by vertical loads, the two North American structures men concluded.

. . . Around the Meeting

Best sellers at the preprint counter were J. V. Long's "Ceramic Coatings Solve High Temperature Problems" and Ralph Kress' "Afterburners and Variable Nozzles." Altogether, 2059 preprints were sold at the meeting.

* * *

The fire alarm that woke Statler guests early the second morning of the Aeronautic Meeting turned out to be only the result of a short circuit in the fire alarm system, not a fire in the Aircraft Engineering Display as first suspected.

* * *

Chairmen and secretaries, respectively, of the 11 technical sessions were

R. L. Schleicher and J. A. Sporcic
E. C. Wells and H. J. Wood
N. W. Bouley and J. H. Famme
F. E. McCreery and C. F. Derbyshire
A. L. Klein
John Kline and T. J. Venator
H. W. Holzapfel and J. M. Brye
R. E. Johnson and J. B. Pitkin
L. D. Bonham and O. E. Brown
P. A. Colman and Victor Hudson
F. H. Sharp and Paul Lansing

* * *

Bob Steeneck of Fafnir—one of the originators of SAE production forums—came out from Cleveland to see the idea applied to West Coast aircraft production problems. Planners and participants in the West Coast panels are carrying on in the finest traditions, he said.

* * *

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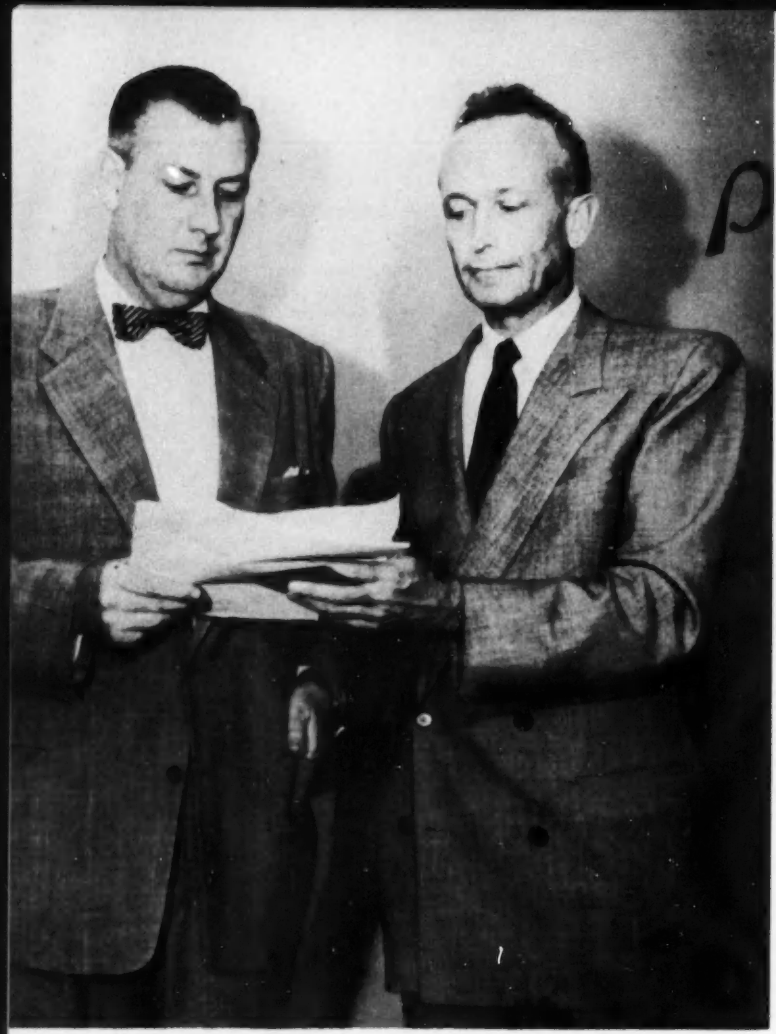
Members of the Production Control Panel at the October 1 Production Forum became known as the "Prisoners of Zenda." When many more people signed up for the discussion than the Statler room assigned could accommodate, hasty negiotiations secured use of the Zenda Ballroom across the street. Panel members occupied the bandstand, and the other participants fired questions at them from the dance floor.

Production



Two men who bore much of the responsibility for the Aircraft Production Forum, Chairman B. C. Monesmith and Sponsor J. L. Atwood

THIS year's all-day Production Forum had the new Hotel Statler bursting its seams to accommodate the more than 1100 manufacturing men who attended the 11 panels. These information-seeking engineers, almost double the number at last year's Forum, exchanged practical ideas in lively discussions.

All agreed the over-capacity crowd and rich harvest of ideas from information swapping stemmed from one factor: a program of panel subjects keyed to today's production problems. The planning job on this program was done by Forum Sponsor J. L. Atwood, General Chairman Burt Monesmith, and the members of their team. A two-day Forum has been suggested for next year.

All 11 panels yielded a high take-home pay in helpful how-to-do-it's and solutions to knotty problems. Production engineers in the airframe industry let down their hair on worrisome situations in processing materials, devising control methods, getting the most out of machining methods, and supervising men.

Engineers unveiled cost-saving ideas in which their companies had invested much time and money. And just for the asking, men from small plants received priceless advice from specialists with larger firms. The give-and-take crossed over competitive lines, extended between prime and subcontractor, buyer and vendor. Here is a sampling of the thoughts aired:

- From the tooling session came forth suggestions on how to keep down tooling costs, despite the trend toward more complex assemblies.
- New techniques for forming (such as hot forming, stretch forming, draw forming, and reduction hand forming) work best in certain applications.
- Three-dimensional machining shared billing with other metal-cutting developments in a panel on that subject.
- Cost control discussions evaluated the worth of time studies.
- Just how far should you go in statistical quality control? Cost-conscious production men worked over this query and came up with answers for varying situations.
- In reducing cost of electronic equipment, most agreed more coordination is needed . . . coordination with engineering, suppliers, and the military services.
- At the panel on plant engineering and plant layout, production men were told to keep an eye on maintenance and best equipment utilization.
- Techniques for installing flush rivets and high-shear fasteners shared billing with other items at the mechanical joining panel.
- Manufacturing men learned that change orders were plaguing most plants and no one had a foolproof way to control changes so as to eliminate confusion and added costs.
- Vendors came away with helpful ideas in handling paperwork at discussions of procurement problems.

Forum at L.A. Biggest Ever

These five members of the Aircraft Production Forum Executive Committee are E. F. Gibian, B. A. Willsey, B. K. Bucey, B. C. Monesmith, and H. W. Thue

Change Control

H. F. Berry, North American; A. P. Schunck, Douglas; Edward Hollister, Lockheed; Panel Leader H. E. Herdrich, Northrop; Panel Co-Leader N. H. Shappell, Douglas; Secretary S. J. Worth, Northrop; and D. N. McIssac, University of Southern California

Manufacturing Cost Control

Secretary John Gronemeyer, North American; Paul Athans, Convair; Herbert Hall, Douglas; Fred Neale, Boeing; Panel Co-Leader Herbert Caldwell, Lockheed; J. C. Mabe, Douglas; and Panel Leader W. F. Snelling, North American

Turn page for more Production Forum pictures

. . . More pictures of the Aeronautic Meeting

Fastening and Mechanical Joining

H. J. Sumner, Convair; Frank Young, Douglas; Jack Kahlo, Northrop; Panel Leader S. N. Bean, Lockheed; Panel Co-Leader L. E. Ganahl, Lockheed; Joerg Litell, Ryan Aeronautical; and Secretary R. L. Hand, Lockheed

Machining

Secretary H. W. Ingalls, Solar Aircraft; C. R. Lewis, Chrysler; Panel Co-Leader J. A. Logan, Solar Aircraft; Panel Leader B. A. Willsey, Solar Aircraft; W. A. Nordhoff, Douglas; Glynn Williams, Axelson Mfg.; and Willard France, Boeing

Forming

Keith A. Wilhelm, Lockheed; H. G. Engler, Ryan Aeronautical; Panel Leader O. A. Wheelon, Douglas; Panel Co-Leader J. S. Corral, North American; H. A. Abling, Boeing; and Secretary Donna M. Ohm, Douglas

Production Forums in action . . .

Production Control

Secretary Roy L. Anderson, Douglas; P. J. Prescott, North American; Panel Co-Leader F. W. Lloyd, Northrop; Panel Leader J. B. Adams, Industrial Plastics; M. A. Garrett, Douglas; C. W. Seymour Jr., Solar Aircraft; C. W. Easton, Boeing

Procurement

J. W. Hinchliffe, Northrop; A. R. Campbell, Rohr Aircraft; W. Shulver Jr., Lockheed; Panel Leader D. J. Bosio, Douglas; Panel Co-Leader R. Nagley, North American; and Secretary C. L. Wade, Douglas

Electronics

L. M. Welsch, Boeing; Lester L. Galloway, North American; Secretary C. H. Hansen, AiResearch; Panel Leader Charles W. Clarke, AiResearch; Panel Co-Leader E. M. Boykin, Hughes Aircraft; M. J. Fayrweather, Northrop; and A. F. DuFresne, Consolidated Engineering

Turn page for more Production Forum pictures

. . . More Production Forum pictures

Quality Control

R. S. Catlin, Northrop; Secretary W. F. Stryker, Douglas; Panel Co-Leader G. H. Prudden, Lockheed; Panel Leader B. W. Clawson, Douglas; Roy E. Paine, Alcoa; I. Dagan, Rohr Aircraft; and George H. McDonald, North American

Plant Engineering and Plant Layout

R. J. Swonk, Lockheed; Secretary K. R. Waltz, Douglas; Panel Leader W. A. Burton, Douglas; Panel Co-Leader H. W. Linton, North American; R. Pleski, Kaiser Mfg.; and R. B. Parkhurst, Hughes Aircraft

Economics of Tooling

E. F. Mellinger, Ryan Aeronautical; C. S. Wagner, Lockheed; C. S. Glasgow, Douglas; Panel Leader B. F. Raynes, Rohr Aircraft; Panel Co-Leader B. K. Bucey, Boeing; R. L. Pollock, North American; G. R. Gordon, Convair; and Secretary R. A. Peterson, Rohr Aircraft

Exhibitors at the SAE Engineering Display held with the Aeronautic Meeting included:

Aeroproducts Division, GMC

Aeroquip Corp.

AiResearch Manufacturing Co.

Barber-Colman Co.

Bendix Aviation Corp.

C & H Supply Co.

Chiksan Co.

Cleveland Pneumatic Tool Co.

Continental Aviation & Engineering Corp.

General Controls Co.

Hi-Shear Rivet Tool Co.

Hydro-Aire, Inc.

Kelite Products, Inc.

Lear, Inc.

Lord Manufacturing Co.

New York Air Brake Co.

Pacific Airmotive Corp.

Pacific Scientific Co.

Resistoflex Corp.

Ryan Aeronautical Co.

Scintilla Magneto Division, Bendix Aviation Corp.

Solar Aircraft Co.

Stratos Division, Fairchild Engine & Airplane Corp.

Vickers, Inc.

Western Gear Works

United States Steel Co.

About

L. IRVING WOOLSON, vice-president in charge of manufacturing and a director of DeSoto Motor Corp., a subsidiary of Chrysler Corp., has been elected president of DeSoto. Woolson has been with Chrysler Corp. for more than 24 years and with DeSoto since 1936. He became operating manager in 1948 and vice-president in 1950.

HAROLD R. HARRIS will become president of Northwest Airlines on Jan. 1. He has been vice-president of Pan American Airlines. During World War II, Harris was brigadier general and chief of staff of the Air Transport Command. He has been vice-president in charge of Atlantic operations for Pan American since 1950. He was SAE vice-president representing Air Transport Activity in 1947.

A. DALE HERMAN has been named vice-president and general manager of Marman Products, Inc., Inglewood, Calif. Herman was previously general manager of the El Segundo Division of Vickers, Inc., and had been with that company for 18 years.

DEXTER S. KIMBALL, JR., has been named general manager of Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio. Kimball joined Bendix-Westinghouse in 1945 as factory manager and has supervised all manufacturing departments, methods, inspection, standards, production control, plant engineering and industrial relations since that time.

EARL F. RIOPELLE has been appointed to the newly-created post of manager of engineering for the Houdaille-Hershey Corp., Detroit. Riopelle joined Houdaille in 1951 as supervisor of engineering for the western divisions. Prior to that he was assistant chief engineer of the Morse Chain Co.

GEORGE B. MOSELEY has been named general sales manager of Firestone Steel Products Co., Akron, Ohio. Moseley, who has been sales manager for contract manufacturing, joined the company in 1949. He was previously sales manager of the Hupp Corp., Cleveland, Ohio.

WALTER A. OLEN has been elected chairman of the board of directors of the Four Wheel Drive Auto Co., Clintonville, Wis., after 42 years as the company's president.

A. E. MOORE has been appointed vice-president and director of research and development of the R. M. Hollingshead Corp., Camden, N. J. Previously director of the new products development division, Moore has been with the company for 29 years. **V. M. MANTZ** has been named director of government and industrial research, reporting to Moore. Mantz joined Hollingshead in 1931 as superintendent of lubricant research, and has since been assistant director of research and most recently director of research.

K. T. KELLER, chairman of Chrysler Corp., has been chosen to receive the 1952 Industrial Award of the Society of Industrial Realtors. The Award recognizes "a most significant contribution to the industrial development of North America in the public interest."

ROBERT J. KRAUSE has been named assistant to the general manager of the Pacific Division of Bendix Aviation Corp., North Hollywood, Calif. Krause joined the Pacific Division six years ago as a missile development engineer, and has most recently been in charge of the division's New York sales office.

DR. ALFRED J. BUCHI of Winterthur, Switzerland, received the George B. Handerson Medal of the Franklin Institute, Philadelphia, Pa., in a ceremony at the Institute on Oct. 15. The citation accompanying the medal states that Buchi has been chosen "in view of his contributions in augmenting the capacity and performance of the four-cycle diesel engine through his supercharging system, in all classes of service, but particularly in the railway field."

Members

Sillcox

Zaoral

LEWIS K. SILLCOX has been elected vice-chairman of the board of the New York Air Brake Co., after serving as executive vice-president of the company since 1949. He came to the company as a vice-president in 1927 from the Chicago, Milwaukee and St. Paul Railroad. **CHARLES T. ZAORAL** has been named vice-president in charge of operations. For the past seven years, Zaoral has been general manager of the international division of Bendix Aviation Corp. and a director of its subsidiaries in Canada and Australia.

RALPH S. DAMON, president of Trans World Airlines, has been elected to the board of directors of the Sheraton Corp.

GEORGE E. STOLL, vice-president and a director of Bendix Aviation Corp., has been named group executive in charge of the Automotive and Mid-Western Divisions. He will continue as general manager of Bendix Products Division, South Bend, Ind.

S. W. G. EDLIN is now superintendent of transport of the City Transport Center of Singapore, Malaya. Edlin was formerly chief mechanical inspector for Singapore's Registrar of Vehicles Department.

THOMAS M. LOGAN has recently returned to Caterpillar Tractor Co. Peoria, Ill., from two years military leave during which he served the Army as commanding officer of the 403rd Engineer Base Depot in Germany. Logan's new post at Caterpillar is engineering and cost analysis manager for the purchasing department. Before being recalled to the Army, he was Caterpillar's manager of service development.

DONALD P. FRANKEL has been appointed special assistant to the director of engineering and manufacturing of Marquardt Aircraft Co., Van Nuys, Calif. Before joining the engineering staff at Marquardt in September, Frankel served as a consulting engineer assigned to headquarters, U. S. Air Force. He has previously served with GMC's Allison Division, Douglas Aircraft Co., and the Air Materiel Command Headquarters.

E. B. NEWILL, vice-president of General Motors and general manager of Allison Division, takes on new duties with the consolidation of GMC's Aeroproducts Division, Dayton, Ohio, with Allison Division. The consolidation is designed to further coordinate Allison's aircraft engine operations with Aeroproducts' propeller production. Dayton operations will be known as Aeroproducts—Allison Division.

HARLAN KNOX PERRILL has been named manager of the engine division of Pacific Airmotive Corp., Burbank, Calif. Perrill, who retired from the U. S. Navy as a commander in 1946, has since served Solar Aircraft Co., Consolidated Vultee, and has most recently been with Hughes Aircraft Co. as industrial engineer.

DWAIN E. FRITZ has been named director of engineering and assistant to the president of Jack and Heintz, Inc., Cleveland, Ohio. Both are newly-created positions. Fritz joined the company in 1948 as manager of the special aviation projects section and for the past three years has been chief engineer.

J. ALLAN MacLEAN has been named director of industrial relations for Bendix Products Division of Bendix Aviation Corp., South Bend, Ind. MacLean joined Bendix in 1940 after serving as assistant professor of aviation engineering at Notre Dame. He has most recently been assistant manager of the aircraft products section at Bendix.

WARREN H. CARHART has been elected vice-president of South Western Gear Works, Houston, Texas. Carhart, who was formerly supervisor of application engineering at the company's Lynwood, Calif., plant, will now manage the Houston plant.

More Promotions at Studebaker

Churchill

Following his recent promotion to be chief engineer of Studebaker (see September SAE Journal, p. 99), **HAROLD E. CHURCHILL** has now been made vice-president of engineering. He succeeds to the post held by the late Stanwood W. Sparrow.

Last month, Churchill announced promotion of **M. P. DeBLUMENTHAL** to chief research engineer (see October SAE Journal, p. 86).

Additional promotions announced this month by Churchill are: **E. J. HARDIG** to become chief passenger car engineer, **W. W. SMITH** to be chief administrative engineer, and **A. G. LAAS** to be chief product engineer. **R. E. MacKENZIE** will continue as chief truck engineer.

Hardig was previously chief chassis engineer; Smith and Laas were executive engineers. Hardig first joined Studebaker as a draftsman in 1919. Smith has been with Studebaker since 1925 and has the distinction of having been the first of its engineers assigned to aircraft projects. He served as production engineer for the Army Air Forces from 1942 until his return to Studebaker in 1945. Laas has been with the company for 25 years; during World War II, he was in charge of receiving inspection at the aviation plant.

Hardig

Smith

Laas

MacKenzie

F. L. BIRD has been appointed operating manager of the Wyoming and Warren Avenue Plants, Detroit, of DeSoto Division of Chrysler Corp. For the past year Bird has been factory manager of the Wyoming Plant, and prior to that was assistant to the operating manager.

ROBERT L. McWILLIAMS has been named staff assistant of the educational relations section of General Motors Corp., Detroit. McWilliams has been a member of GM's engineering staff since 1940 and since 1948 has headed the technical data department. In his new assignment, he will handle college contacts in connection with General Motors' educational relations program, as well as the development of informational material to be made available to engineering colleges.

WALTER D. FOLLIS is now general superintendent of Ford Motor Co. of South Africa, Ltd., in Port Elizabeth, South Africa. He was formerly works manager of South African Motor Assemblers and Distributors, Ltd.

BERNARD GOLDMAN has joined Ford Instrument Co., a division of the Sperry Corp., Long Island City, N. Y. as senior technical writer in the publications department. He was formerly supervisor of technical publications for Stanley Aviation Corp., Buffalo, N. Y.

ROBERT G. CUMMINGS is now district representative in Detroit for the H. T. Kennedy Co., New York City. Cummings was previously section supervisor of engineering in the engineering laboratory of Ford Motor Co.

JAMES C. BLAKE has joined General Electric Co. at Lockland, Ohio, as a technical engineer in the aircraft nuclear propulsion project. Blake was formerly a project engineer for Sperry Gyroscope Co., Great Neck, N. Y.

FRED R. HILSON is now sales manager of the Battery and Starter Co., Inc., Buffalo, N. Y. Hilson was previously general sales manager of Auto Electric Service Co., Inc., in Toronto, Ont.

CHARLES N. HASKINS has been promoted to Chicago district sales manager for the Fram Corp. of Providence, R. I. Haskins was formerly industrial sales engineer in Fram's Houston, Texas, office.

DOYLE C. REYNOLDS is now special representative in sales development for Caterpillar Tractor Co., Peoria, Ill. Reynolds was formerly with the off-highway department of Mack Truck Co.'s central division in Chicago.

JOHN T. FORD has been promoted to design supervisor in the body department of GMC's Chevrolet Motor Division, Detroit. Ford was previously senior body designer for Chevrolet.

DONALD L. POWELL is now a lieutenant, j.g., in the U. S. Navy stationed in Washington, D. C., as planning and facilities officer for the torpedo branch of the Navy's Bureau of Ordnance. Powell spent last year in Istanbul, Turkey, as visiting lecturer in mechanical engineering at Robert College, and prior to that was with Standard Oil Co. (Ind.) at Whiting, Ind.

G. WALLACE ZELLER is now president of South Jersey Autos, Inc., Haddonfield, N. J. Zeller was formerly with Rohrer Chevrolet Co., Camden, N. J., as director of service.

JOHN F. SOCOLOFSKY has been promoted to supervisor of the fuels and lubricants section in the research and development department of Socony-Vacuum Oil Co., Inc., Paulsboro, N. J. Socolofsky was formerly assistant supervisor of the products section.

RICHARD L. BERRY has been named manager of ABK laminated plastic sales for American Brakeblok Division of American Brake Shoe Co., Chicago, Ill. Berry was previously a sales engineer for the company.

JAMES H. ROBERTS, formerly design engineer for Buffalo-Springfield Roller Co., Springfield, Ohio, has joined the Steel Products Engineering Co., also in Springfield, as assistant project engineer.

JACK A. GREEN has joined Northrop Aircraft, Inc., Hawthorne, Calif., as a flight test analyst at the Muroc Dry Lake experimental flight test station. Green was previously with the engineering laboratory of Ford Motor Co. as schedule follow-up man.

M. W. HALL is now in Los Angeles, Calif., as regional sales engineer for Reynolds Metals Co. Hall was formerly representative of Thompson Engine Service in Fort Worth, Texas.

EDWARD H. LEDBETTER has joined the Diesel Construction Equipment Co., San Diego, Calif., as shop foreman of the engine department. He was previously with Roy-Owen Truck Service, Lancaster, Calif.

WILLIAM P. BARNES is now assistant professor of mechanical engineering at the University of Utah in Salt Lake City. Barnes was previously research engineer at the Lewis Flight Propulsion Laboratory of NACA in Cleveland, Ohio.

ROBERT C. JONES has returned to the United States to become research technical advisor for Shell Oil Co., with offices in New York City. Jones was previously technical advisor for Royal Dutch Shell in The Hague, Holland.

CAREY F. RAMEY is now vice-president of Faber Laboratories of New York, Inc., in New York City. Ramey retired from the post of assistant manager of the product acceptance department of Standard Oil Co. of California on Sept. 1, after 43 years with the company.

PAUL W. FULLER is now a design engineer for Acme Engineering Co., Muskegon Heights, Mich. He was previously with General American Aerocoach Co., East Chicago, Ind. Fuller is a past president of SAE's Western Michigan Section.

H. M. JACKLIN is now professor of mechanical engineering and head of the mechanical engineering department at Ohio Northern University, Ada, Ohio. He will continue the consulting engineering practice in which he has been engaged for the past 9 years.

M. M. SALIM has been promoted to general manager of Orient Airways, Ltd., Karachi, Pakistan. Prior to this, he was Orient's chief engineer.

E. BROOKHOUZEN has been promoted to staff engineer with the engineering department of Caterpillar Tractor Co., Peoria, Ill. Brookhouzen joined Caterpillar in 1934 as a trainee in the machinist apprentice course, and entered the engineering department on graduation. He has most recently served as designer.

ALFRED W. SIEVING has been named supervisor of rubber-tired tractors for the engineering department of Caterpillar Tractor Co., Peoria, Ill. Sieving joined the company in 1937 in the tool design department and transferred to the engineering department as a transmission designer in 1942.

New Assignments at Pratt and Whitney Aircraft

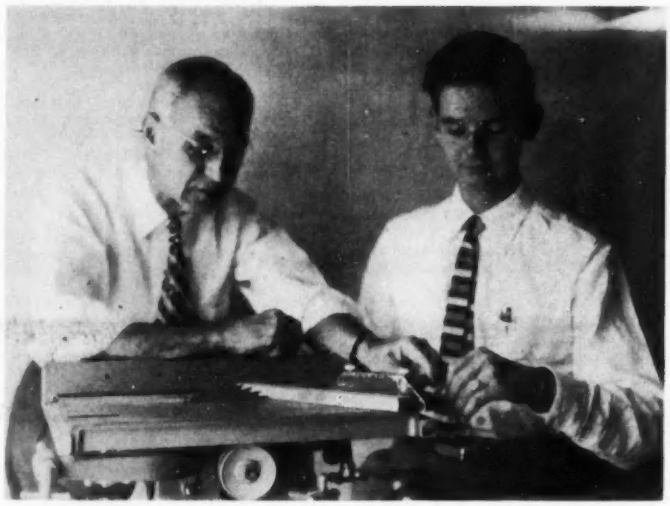
Fischbeck

Deming

HENRY J. FISCHBECK has been appointed staff metallurgist in the advanced tool engineering group at Pratt and Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn. Fischbeck, who for the past 10 years has been supervisor of metallurgical and chemical processing in the production engineering department, will be succeeded by **SPENCER W. DEMING**, assistant supervisor since 1945.

Fischbeck joined Pratt and Whitney in 1929 as chief metallurgist and organized the metallurgical and heat-treating departments. Deming has been with the company since 1940, and was named assistant supervisor of metallurgical and chemical processing in 1945.

SAE Father and Son—and Grandson



Newest Grandfather and Grandson team in SAE are **J. M. CRAWFORD** and **JAMES CRAWFORD MOULE.** Grandson "Jimmy," a freshman at California Institute of Technology, has just become an SAE Enrolled Student. The photograph was taken at the new LaJolla, Calif., hillside home home overlooking the Pacific, where SAE Past-President Crawford spends much time since his retirement last year as vice-president of General Motors Corp.

If any SAE reader knows of SAE Father-and-Son combinations, both of whom are members of the Society, your editors would appreciate hearing from you. We will write for photographs. Informal pictures are preferred to individual formal portraits. Your cooperation will be deeply appreciated—we don't want to miss any SAE grouping.

Snapped at the Tractor and Production Forum in Milwaukee in September are SAE father **JOHN T. LIGGETT,** assistant chief engineer of Allis-Chalmers Mfg. Co., and son **JOHN R. LIGGETT,** who is a field engineer for Timken Roller Bearing Co. The senior Liggett, an SAE member since 1919, is 1952-53 chairman of Central Illinois Section.

DONALD W. WING has been named chief engineer of the Available Truck Co., Chicago, Ill. Wing was previously assistant manager of engineering for Precision Scientific Co. in Chicago.

HARRY HAWKINS has been promoted to assistant works manager in charge of defense work at Saginaw Steering Gear Division of General Motors, Saginaw, Mich. He was formerly sales and service manager.

HENRY M. HAAN is now with Nieuwe Afrikaansche Handels Vennootschap, S.A., in Leopoldville, Belgian Congo. He was formerly engineer for the Bureau Technique Bia in Leopoldville.

RAY F. WILKIE has joined the tractor division of Allis-Chalmers Mfg. Co., Milwaukee, Wis., as application engineer. Wilkie was previously an automotive proof engineer at the Army's Aberdeen Proving Ground, Aberdeen, Md.

CHARLES S. PARKER is now with the manufacturers sales department of American Bosch Corp. in Springfield, Mass. Parker has previously served American Bosch as field engineer at the Cleveland and Detroit branch offices.

ROBERT P. ERNEST has joined Ford Motor Co.'s engineering laboratory, Dearborn, Mich., as a research engineer. Ernest was formerly design engineer for Hoffman Motor Developments Co.

RICHARD R. GOODWIN has joined Chevrolet Motors Division of General Motors Corp., Detroit, as a project engineer on automotive accessories. Goodwin was previously a project engineer for Holley Carburetor Co., Detroit.

E. V. ALBERT, who was formerly with the aviation technical service of the Texas Co. in New York City, has joined the aircraft gas turbine division of General Electric Co., Lockland, Ohio, as technical engineer on installations analysis.

HARVEY S. FIRESTONE, JR., has been honored for his work as chairman of the Presiding Bishop's Committee on Layman's Work by a resolution of appreciation adopted by the House of Bishops at the general convention of the Protestant Episcopal Church held Sept. 7–19 in Boston, Mass.

MAJOR GEORGE A. TUTTLE, who was an instructor in engineering drawing at the U. S. Military Academy at West Point, N. Y., is now taking the advance ordnance course at Aberdeen Proving Ground, Aberdeen, Md.

Batt Honored by American Standards Association

On November 25, **WILLIAM L. BATT** will receive from the American Standards Association the Howard Coonley Medal for distinguished service in the standardization movement. He is now minister in charge of the Economic Cooperation Administration Mission to the United Kingdom and president of SKF Industries, Inc.

One of Mr. Batt's signal services in the standardization area was as chairman of the Sponsors' Council, which was the United States industry group responsible for steering the American-British-Canadian screw thread unification project.

C. R. SCOTT has been named sales manager of Wolf's Head Oil Refining Co., Oil City, Pa. Scott has been with Wolf's Head since 1933 in a number of capacities, and is a member of the company's marketing committee and refinery operations committee. He is a vice-chairman of SAE's Pittsburgh Section.

SIDNEY H. WEBSTER has been appointed sales manager of Aviation Engineering Corp., Woodside, N. Y. Webster was previously manager of the west coast sales and engineering office of Eclipse-Pioneer Division of Bendix Aviation Corp. in Burbank, Calif.

ALLEN P. BLADE, who was formerly with the U. S. Atomic Energy Commission as an equipment specialist, is now with the Munitions Board of the Department of Defense. Blade is field editor of Washington Section.

A. V. PILLING has been appointed staff engineer in charge of powerplant and flight test engineering projects for Hayes Aircraft Corp., Birmingham, Ala. Pilling was previously a member of the sales and engineering departments of Wright Aeronautical Corp., Wood-Ridge, N. J., as airline consultant engineer.

WALTER F. SKINNER recently resigned as vice-president, director and sales manager of Woodall Industries, Inc., Detroit, to organize the Skinner-Adams Co., manufacturers' representatives, at 18323 James Couzens Highway, Detroit. Skinner had been with Woodall Industries for 24 years.

MAURICE PLATT, executive engineer of Vauxhall Motors, Ltd., in Bedfordshire, England, has been elected chairman of the Automobile Division of the Institution of Mechanical Engineers. Platt took office at the Institution's first fall session on Oct. 7 and gave an address on "The Changing Practice of Automobile Engineering."

JOHN D. ROGERS has been named automotive technologist for the Petroleum Chemicals Division of E. I. duPont de Nemours. He was previously a senior engineer at the company's petroleum laboratory, and prior to that was with Standard Oil Co. of California.

GEORGE E. MASON has been named chairman of the Manitoba Chapter of the American Society for Metals for the 1952–53 season. Mason is chief engineer of the coach division of Motor Coach Industries, Ltd., Winnipeg, Man.

JOHN B. HULSE, managing director of the Truck-Trailer Manufacturers' Association and chairman of Washington Section, was graduated from courses of the National Institute of Trade Association Management on Sept. 16 at a ceremony in Toronto, Ont.

KENNETH G. BROMAN is now director of sales engineering in the New England area for Miniature Precision Bearings, Inc., Keene, N. H. Broman was formerly with Matthews Mfg. Co., Worcester, Mass., as a sales engineer.

CHARLES R. BRADLEE, who was formerly equipment engineer for General Cable Corp., St. Louis, Mo., has joined the process development section of General Motors Corp. as a junior engineer.

ARTHUR CHARLES METTLER, who was formerly field service representative for E. P. Lawson and Co., is now a manufacturers' agent with offices at 516 Fifth Avenue, New York City.

M. T. MOLER has been named advertising manager of United Specialties Co., Chicago, Ill. Moler has been with the company since 1945 as a sales engineer.

ANDREW I. JOHNSON, who was previously a graduate assistant in the mechanical engineering department of the State University of Iowa, is now an instructor of mechanical engineering at Case Institute of Technology, Cleveland, Ohio.

ARNOLD B. MEDBERY, formerly blower engineer for the Elliott Co., Jeannette, Pa., is now with the Trane Co., LaCrosse, Wis.

RAYMOND W. SNOWBERGER is now sales representative in Dallas, Texas, for Southern Coach Mfg. Co., Inc., Evergreen, Ala. Snowberger was previously sales manager for Southwest Marmon-Herrington Coaches, Inc., Dallas.

HAROLD I. JOHNSON has been promoted to production engineer for Chevrolet Aviation Engine Division of General Motors Corp. Johnson, who joined the division last year, was previously a project engineer.

CARL D. LYNN, staff engineer for the lube department of Shell Oil Co., has been transferred from Shell's offices in New York City to Los Angeles, Calif.

N. B. DICKEN is now executive engineer at the John Deere Dubuque Tractor Works, Dubuque, Iowa. Dicken was previously development engineer for Firestone Tire and Rubber Co., Akron, Ohio.

JACK A. SCANLAN, JR., assistant professor of mechanical engineering and associate director of the engine research laboratory at the University of Texas, is on a year's leave of absence to visit Northwestern University, where he will teach a number of courses and do advanced study.

PAUL A. DAILY is now general manager of Cummins and Moran of New Mexico, Albuquerque, N. M. Daily was previously with Cummins Sales and Service, New Orleans, La., as district manager.

LT. COL. JOHN H. DAVIS has completed work at the Army's Command and General Staff College and is now working on the coordination and direction of research and development of Ordnance Corps wheeled vehicles at the Pentagon Building, Washington, D. C.

HANNES A. RUESCH is now with the ceramic division of Champion Spark Plug Co. in Detroit as design engineer. Ruesch was formerly a designer for Landis and Gyr A. G. in Zug, Switzerland.

CHARLES R. MOYER has joined Reaction Motors, Inc., Rockaway, N. J., as assistant project engineer. He was previously with Lear, Inc., Grand Rapids, Mich., as design engineer.

ADOLPH J. ALBRECHT is now sales engineer for the Griscom-Russell Co. in New York City. Albrecht was formerly assistant to the chief mechanical engineer of the Permutit Co., New York City.

STANLEY GOLDSTEIN is now a project engineer with South Wind Division of Stewart-Warner Corp., Indianapolis, Ind. He was formerly project engineer with Consolidated Diesel Electric Corp., Stamford, Conn.

The American Society for Testing Materials has announced the elections of Robert J. Painter as executive secretary of the Society and Raymond E. Hess as associate executive secretary and editor in chief. Both men have been with the Society, which has headquarters in Philadelphia, Pa., for many years. Hess has been assistant executive secretary and editor, and Painter has most recently been treasurer and assistant secretary.

JOE H. TALLEY has been named director of aviation sales for Willys-Overland Motors, Inc., Toledo, Ohio. He was previously preliminary design engineer for Consolidated Vultee Aircraft Corp. in Fort Worth, Texas.

WALTER R. DEBLER is now an ensign at the U. S. Navy's Bureau of Aeronautics, Washington, D. C., assigned to the standardization and specifications section. He was previously a test engineer for Continental Aviation and Engineering Corp., Detroit.

CAPT. RICHARD M. OLIVER of the U. S. Navy is now assigned to North American Aviation's Columbus, Ohio, division as representative for the Navy's Bureau of Aeronautics. Captain Oliver was formerly commanding officer of the Naval Air Station at Glenview, Ill.

C. D. WALTHALL is now division automotive sales engineer for the Pure Oil Co. in Charlotte, N. C. Walthall was formerly lubrication engineer for Pure Oil in Richmond, Va.

JOHN B. MOORE, who was formerly general sales manager of the Aviation-Industrial Division of Fine Organics, Inc., has organized the John B. Moore Corp. in Nutley, N. J., to market safety solvents and offer safety consultation services.

PAUL J. LANSING is now a design specialist for Consolidated Vultee Aircraft Corp., San Diego, Calif. He was previously chief technologist at the Inglewood, Calif., laboratory of Thompson Products, Inc.

CLARENCE E. FRANK has joined GMC's Chevrolet Motor Division as project engineer on suspensions and steering mechanism. He was formerly with Chrysler Corp.

J. MASKELL is now in Bristol, England, as representative of Canadair, Ltd., of Montreal, at the Bristol Airplane Co.

EARLE F. COX is now tractor project engineer for Harris Mfg. Co., Stockton, Calif. Cox was previously research professor at the University of Massachusetts.

SETH P. NORDLING has joined Willamette Iron and Steel Co., Portland, Ore., as a design engineer. He was previously layout draftsman for Caterpillar Tractor Co., Peoria, Ill.

SAE Members earn ASA Service Certificates

Four SAE members were among those who received certificates of service from the American Standards Association at the Third National Standardization Conference held in Chicago Sept. 8–10. They are: (1) **FRANK P. TISCH** of Pheoll Mfg. Co.; (2) **GEORGE L. McCAIN** of Chrysler Corp.; (3) **R. C. W. PETERSON** of Peterson Engineering Co.; and (4) **T. M. ROBIE** of Fairbanks, Morse and Co. Complete roster of those presented awards is (left to right): Tisch, McCain, E. H. Weaver, W. E. Bloecker, Peterson, J. H. Foote, Robie, A. G. Jensen, H. C. Dean, and Roger E. Gay, president of the American Standards Association, who made the awards.

Eaton Manufacturing Co. Promotions

Davies

Christie

JOHN L. DAVIES has been promoted to assistant chief engineer of the Eaton Mfg. Co., Cleveland, Ohio, to succeed the late **HARRY H. HOOKER**. Davies, who was previously assistant to Hooker, has been with Eaton since 1923. **CHESTER D. CHRISTIE** has been appointed staff engineer, and will assume many of the duties previously handled by Davies. Christie has been with the company since 1939, but served as a major in the Army's 9th Armored Division from 1941 to 1945.

JAMES E. RISSMAN has joined the Fluor Corp., Ltd., Los Angeles, Calif., as a research engineer. Rissman was previously research engineer at Ethyl Corp.'s research laboratories in Detroit.

JOSEPH G. LISCOUSKI, JR., has been appointed director of public relations for the Academy of Aeronautics at LaGuardia Field, N. Y. He was previously head of the Academy's technical department.

JOHN F. DICKMANN is now automotive engineer for the petroleum chemicals division of E. I. duPont de Nemours and Co. in Tulsa, Okla. He previously held the same title with the Texas Co., Dallas.

CHARLES M. WEBB, who was previously fleet engineer for the General Tire Co. of St. Louis, Mo., is now fleet engineer for Rudy and George, Inc., in St. Louis.

DOUGLAS A. PHILBROOK, who was formerly manager of the Northeast Pulpwood Research Center, Gorham, N. H., is now logging engineer for the Improved Paper Machinery Corp. in Nashua, N. H.

EDWARD D. VOSBURGH, who was previously with the Torrington Co., Torrington, Conn., is now a technical writer with the service department of Ford Division, Ford Motor Co.

JOHN R. QUINZIO has joined the Niagara Mohawk Power Corp., Buffalo, N. Y., as design engineer. He was previously plant engineer for American District Steam Co., Inc., North Tonawanda, N. Y.

THOMAS P. CHRISTEN, JR., has been named manager of farm sales for the Standard Oil Co. (Ohio), Cleveland. For the past five years, Christen has served the company as agricultural engineer in the department of sales engineering. During World War II he was a field artillery officer in the U. S. Army.

M. DEAN KLINGER has joined the Sinclair Refining Co. in Peoria, Ill., as industrial sales representative. Klinger was formerly an assistant test engineer at Armour Research Foundation of Illinois Institute of Technology, Chicago.

JOHN W. REED, JR., has been named sales manager of the government sales division of the R. M. Hollingshead Corp., Camden, N. J. Reed was previously west coast representative for Hollingshead's industrial division.

PAUL R. ELDER has been promoted to assistant district manager for Gulf Oil Corp., Trenton, N. J. He was previously a member of Gulf's sales department.

RAFAEL H. BRAND, who was formerly a research engineer at the Pennsylvania State College's experiment station, is now research engineer at the Benger Laboratory, Waynesboro, Va., of E. I. duPont de Nemours and Co.

JOSEPH C. HAILE has been promoted to chief production engineer of Adel Division of General Metals Corp., Burbank, Calif. Haile was previously liaison engineer and technical writer for the division.

JOHN E. LINDBERG, JR., and **JAMES W. WHEELER** were awarded the Musick Memorial Trophy of the Royal New Zealand Aero Club on Oct. 31 for their joint development of the Sperry engine analyzer, an electronic device for detecting and identifying ignition and mechanical troubles in aircraft powerplants during operation. Wheeler is head of the engine instrument department of Sperry Gyroscope Corp., and Lindberg is now president of Lindberg Engineering Co. The award was made at a luncheon given by the Institute of the Aeronautical Sciences at the Wings Club in New York City.

WARREN R. SALZMAN is now a junior design engineer for Cummins Engine Co., Columbus, Ind. He was formerly with Allis-Chalmers Mfg. Co., Springfield, Ill., as a draftsman.

FREDERICK F. DENNY has been appointed manager of the midland sales district of the Lamp Division of General Electric Co., with headquarters in Chicago. Denny has been attached to the sales staff of the motor city sales district in Detroit for the past three years. He has been with General Electric since 1930.

SAM TOUR, chairman and secretary of Sam Tour and Co., Inc., New York City, has been elected vice-president of the Metals Science Club of New York for 1952–53.

JAMES T. OVERBEY has been released from the U. S. Air Force and is now doing graduate study at Ohio State University. Overbey has been serving the Air Force as a captain and chief of the systems design branch at Wright-Patterson Air Force Base, Dayton, Ohio.

FRED A. ROBBINS, who was formerly a senior project engineer for the Electro-Motive Division of General Motors Corp., LaGrange, Ill., has joined Stan Roper Motors, Inc., Benton Harbor, Mich., as a salesman.

WILLIAM H. BUSHKIN has been transferred from Seattle to San Francisco as regional service manager for the central service division of Mopar Motor Parts Corp., a subsidiary of Chrysler Corp. Bushkin has been regional service manager in Seattle since 1937.

D. PAUL FISHER has joined the engineering department of the Chevrolet Central Office, Detroit, as truck operations engineer. He will maintain engineering contact with Chevrolet zones and dealers and investigate operating conditions and customer requirements from a design and performance standpoint. Before joining Chevrolet, Fisher had been with Bendix Products Division of Bendix Aviation Corp., South Bend, Ind., for 21 years. For the past 17 years he has been field engineer on vacuum power equipment.

CARL F. PRUTTON has been named to head the Mathieson Development Co., a new division of Mathieson Chemical Corp., New York City. Prutton was previously director of research for the corporation, as well as a consultant for the Lubrizol Corp., Cleveland, Ohio.

F. R. BANKS, who was general manager and chief engineer of Associated Ethyl Co., Ltd., London, England, has been released from Ethyl to serve as principal director of engine research and development of the British Ministry of Supply.

Obituaries

EDMUND B. NEIL

Edmund B. Neil, consulting engineer of Columbus, Ohio, died on August 30 following a heart attack suffered about 10 days earlier. He was 62 years of age.

During the last few years, Neil had been doing extensive research in the thermodynamics of steam powerplants. At the time of his death, he had near completion a new, light-weight steam powerplant. He was also associated in a consulting capacity with Francis W. Davis on power steering projects.

Neil started work for the Pierce-Arrow Motor Car Co. immediately after his graduation as a B.M.E. from Ohio State University in 1915. At Pierce-Arrow, where he remained until the early 20's, he became assistant truck engineer.

Later he held other engineering posts, and for a period ending in 1932 was head of the research department of the automotive division of the Chilton Co. in Philadelphia. Later still he was with N. Y. Ayer & Sons and Denham & Co. in Detroit.

During World War II, he taught Army and Navy students at Ohio State University and Wright Field.

Throughout his life, Neil was a regular contributor to the technical press. One of his last major contributions was the paper on "Thermodynamics of Vapor Powerplants" presented at the 1947 SAE Summer Meeting and printed in the 1948 SAE Transactions. In 1930-31 he was chairman of the SAE Philadelphia Section.

He had unusual analytical ability and a vast store of engineering knowledge in many fields. His recreation consisted largely of buying, driving and reconditioning automobiles of relatively ancient vintage. His personal cars were usually hybrids of one kind or another, the product of his never-flagging interest in working with and on motor vehicles.

HERBERT A. ROBERTS

Herbert A. Roberts, 49, president and general manager of Roberts Brothers Co. of Washington, D. C., died Oct. 4. Roberts was chairman of SAE's Washington Section in 1950-51.

He was born in Calumet, Mich., and was a salesman in various parts of the country for Thermoid Rubber Co. and Electric Auto-Lite Co. for 16 years. He moved to Washington 11 years ago and formed the Roberts Brothers Co. with his two brothers.

In addition to his activities for SAE, Roberts was a past president of the Greater Washington Automotive Distributors Association and a member of the National Standard Parts Association, the Automotive Electric Association and the Cosmopolitan Club.

Roberts is survived by his wife and a son.

H. A. MASON

H. A. Mason, assistant to the manager of laboratories of General Petroleum Corp., Los Angeles, died Oct. 7. He had been on leave from his post since January for reasons of health. He was 58.

Mason was a native of Alhambra, Calif., and graduated from the University of California in 1917 with a degree in chemistry. He joined General Petroleum as a chemist immediately after graduation, and was named assistant to the manager of laboratories in 1947.

Mason was a member of the American Chemical Society and the committee of fuel research of the American Petroleum Institute as well as of SAE.

He is survived by his wife and two sons.

GEORGE H. EATON

George H. Eaton, automotive field supervisor for the Atlantic Refining Co. in Dallas, Texas, died suddenly Sept. 15 at the age of 63.

Eaton, a native of Wheeler, Pa., had been with Atlantic for 20 years. He had been engaged in the supervision of truck preventive maintenance work for both the sales division in the east and the domestic crude oil producing division in the southwest. He had supervised the Atlantic shop in Dallas for the past two years.

HARRY JAMES MERO

Harry James Mero, president and general manager of Truscon Steel Co. of Canada, Ltd., died suddenly in Toronto on Sept. 13. He was in his 67th year.

Mero was appointed vice-president and works manager of Truscon Steel Co. of Canada in 1920. He was named president and general manager in 1926, and has played an important role in the growth and development of the company.

He was actively interested in local affairs, and served on the Commission that handled the financial arrangements for amalgamating the Canadian Municipalities bordering the Detroit River into the City of Windsor, Ont., during 1935.

Mero was a director of the Union Gas Co., the Polymer Crown Co., and Consolidated Bakeries of Canada, as well as of many local companies. He had been an SAE member for 10 years.

WILLIAM G. IRELAND

William G. Ireland, 55, died Oct. 12 after a long illness. Ireland was assistant to the president of Bundy Tubing Co., Detroit, and was formerly Bundy's vice-president and general manager.

Ireland began his career with the Ireland and Matthew Mfg. Co., of which he became an officer, and was later vice-president and general manager of Eaton Mfg. Co., Cleveland. He later held the same position with the Standard Products Corp. of Detroit. He joined Bundy Tubing Co. as vice-president and general manager in 1942, and became assistant to the president two months before his death.

He was a member of the Detroit Board of Commerce.

Ireland is survived by his wife, a daughter, and three sons.

HOWARD F. FRITCH

Howard F. Fritch, president of the New England Transportation Co., Boston, died Oct. 17. He was 64 years old.

Fritch was also president of the Connecticut Co. and the County Transportation Co. He was a former director of the Boston and Maine Railroad and was an organizer of the Boston and Maine Transportation Co.

A graduate of Worcester Polytechnic Institute, Fritch started in the transport industry with the Eastern Massachusetts Street Railway, joining the Boston and Maine Railroad in 1924.

Fritch was a past chairman of SAE's New England Section. He is survived by his wife and a son.

JAMES E. HURN

James E. Hurn, 49, died August 12 of a cardiac condition. He was president of the Research Engineering Corp. of LaPorte, Ind.

Hurn was the holder of the original Deluxe Products Corp. patents, under which that company manufactures oil filters, and during the early years of the company headed the engineering department. He had been inactive with Deluxe for the last few years, and was working on the development of a new diesel for Research Engineering Corp., which he organized and headed.

In recent years Hurn devoted much of his time to cattle ranching interests in Arizona.

He was a member of the YMCA board of directors in LaPorte. A 32nd degree Mason and a Shriner, he also belonged to the LaPorte Kiwanis Club and the Elks Lodge.

Hurn is survived by his wife and daughter.

November SECTION MEETINGS

Continued from Page 62

Pratt and Whitney Aircraft. Presentation of 25 and 35 Year Certificates.

Spokane-Intermountain—Nov. 14

Wright's Diner. Dinner 6:30 p.m., meeting 8:00 p.m. "Pipe Line on Wheels" and "Korean Film" will be shown (courtesy of Fairchild Air Force Base).

Syracuse—Nov. 24

The Auto Engineers Contribution to Highway Safety—Louis Otto.

Texas—Nov. 14

Italian Village Restaurant, Dallas. Dinner 7:30 p.m., meeting 8:15 p.m. Report on 1952 British Air Show—Herb Hinckley. Testing XS-1 Rocket Ship—Benson Hamlin. Aircraft Carrier Operation—Dr. Jack Frankland. Social Hour 6:30 p.m. sponsored by Chance Vought Aircraft.

Twin-City—Nov. 12

Minneapolis-Honeywell Co.. Dinner 6:30 p.m., meeting 8:00 p.m. Field trip through Aeronautical Division. Members and applicants only.

Washington—Nov. 18

A representative from the Applied Physics Laboratory of Johns Hopkins University will speak on guided missiles.

Western Michigan—Nov. 18

Bill Stern's Steak House. Dinner 6:30 p.m., meeting 8:00 p.m. Crawler Tractors in the Construction Industry —Merrill R. Bennett, chief engineer, International Harvester Co.

Williamsport—Dec. 1

Dinner 6:45 p.m., meeting 8:00 p.m. Ram Jets—Jack Charshafian, engineer, Wright Aeronautical Corp.

Shell Molding Wins Increasing Interest

Based on paper by

WILLIAM G. GUDE

Managing Editor, Foundry

SHELL molding offers a potential cost saving, a saving reflected in the finished machined part if not in the rough casting. Actually, such castings are relatively expensive, but they require less machining and cleaning than conventional sand castings.

Physical properties, internal soundness, surface finish, and dimensional accuracy are somewhat superior to those of sand castings. Tolerances of 0.003 in. per in. are attainable in iron, aluminum, and copper-base alloys in fairly large castings. While dimensional tolerances lie midway between those of sand castings and precision investment castings, the tolerances of the latter would probably be no better if castings the size of those made with shell molds were attempted.

In attaining dimensional accuracy, the user of shell molds has factors to contend with not met by the precision caster. There is the need to assemble two mold halves along a parting line which requires care to prevent dimensional errors in the mating and in the removal of metal fins along the parting. The investment caster can overcome the problem of draft in a comparatively complicated casting by making an assembly of composite wax or mercury pattern pieces. This is impossible with shell molding. The parting line also creates difficulty in attaining outside diameter concentricity on a vertically parted cylinder. If the deficiency matters it can be overcome partly by allowance on the pattern.

Not every casting design is suited to shell molding. Tooling costs are relatively high; therefore, production must be sufficiently large to absorb this cost. Moreover, the design must lend itself to a suitable parting and gating arrangement. No definite size limitations have been established as yet. A roller for a track type tractor has been shell molded with an as-cast weight of 177 lb. Automotive engine blocks are said to be made on a commercial basis in Europe.

Recently, attention has been focused on developing equipment and materials which will mechanize mold making and speed up the process. Several such machines, largely automatic, and capable of producing 45 to 60 shells an hour with unskilled labor, have been placed on the market in recent months. (Paper, "The Role of Castings in the Agricultural Industry," was presented at SAE National Tractor Meeting, Milwaukee, Sept. 10, 1952. It is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members; 50¢ to nonmembers).

Steps in Creation Of New Model Design

Based on paper by

JOHN F. ZIMMERLY

Ford Motor Co.

GIVEN the problem of designing the Nineteen Fifty-X model, the first step is to establish a basic package size covering all specifications so the car can be designed around them. The basis for the package is a drawing, usually provided by the head of the engineering department. The dimensions given represent the best judgment of all the divisions involved, arrived at by conference and compromise. These dimensions are virtually mandatory. Certain dimensions are established by law. Distance of head and tail lamps from the road, are a case in point.

The next step is to plan comfortable and safe arrangements for the passengers within the limited volume available. Years of experience have provided near standards for these dimensions. Giving the passenger sufficient head and leg room as well as easy entrance and exit has influence on the final appearance of the vehicle.

Roughing out the basic lines of the model in 3/8 in. size, then follows. With basic sections on paper, templates can then be made for translation into the three dimensional forms of clay where actual appearance becomes visible. Several 3/8 in. clay

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NEWS OF SAE

pages 87–93

WHO SHOULD REPAIR . . .

. . . fleet vehicles to be argued by operators and factory men. Panel of six will handle this "hot potato" under T & M auspices.

"SHALL we set up a shop to handle our own vehicle repairs or shall we turn repairs over to a factory branch or dealer shop?" Fleet men have been arguing this one for quite a while, and it's waxing hot right now. The issue is due to get an airing by three factory service men and three fleet operators next January at Annual Meeting.

Serving as interlocutor at this session will be "Bob" Gardner, of Lever Bros. With him on the program are:

- F. K. Glynn, American Telephone and Telegraph Co.
- W. H. Langseder, Thomas J. Lipton, Inc.
- R. W. Thomas, Quality Bakers
- Carl W. Doman, Ford Motor Co.
- Freeman G. Allen, White Motor Co.
- W. W. Edwards, GMC Truck & Coach Division

As Gardner sees it, the controversy really boils down to finding an engineering approach to service problems. The real goal is getting most effective use of fleet with repair costs kept to a minimum. What may give best results for one type operation may not do at all for another fleet operation.

It's in weighing all the details in the fleet shop versus dealer or factory repairs where the differences crop up.

Panel member F. K. Glynn anticipates animated discussion on a number of these points. For example, with fleet shops the tendency may be toward too elaborate repairs, with repair men building and installing "gimcracks." Dealer shops may try to stretch a small repair into a sizable bill, or leave a 2¢ worn part in the most inaccessible spot in the unit assembly.

If a fleet shop turns out defective work, the job has to go back for rework . . . and the fleet absorbs this added cost. A dealer shop cannot charge for defective work sent back to it.

Those who argue for purchased repair service come up with a lot of other arguments too. They say:

- A fleet superintendent buying repairs can give more time to operating economies. He has no repair shop to take up his time.
- In operations where the vehicles are not the main business, but only a provider of service, hundreds of thousands of dollars may be tied up in a repair shop. That money can earn a profit for the company if invested in its main business.
- Much money can be tied up in inventory of spare parts. With some fleets it runs into several hundred dollars per vehicle.
- A fleet shop is not as flexible personnel-wise. Because the dealer or factory branch shops get their work from various sources, their work load is evener.

It took plenty of concentrating and planning to come up with the two "hot" sessions being sponsored by the SAE Transportation & Maintenance Activity Committee at Annual Meeting. (See story for details.) Leaders of this group, shown during a serious moment at one of the Committee's meetings are: T & M Activity Vice-President Linn Edsall (left), and T & M Vice-Chairman for Meetings Orville Brouer

The Annual Meeting session is expected to show that purchased service probably is suited more to some type fleets than others. For example, a fleet concentrated in one area—like a city trucking operation—probably keeps all its vehicles under one roof. There the fleet repair shop may show up to advantage. But a scattered fleet will roll up higher dead mileage getting to a central fleet shop than to the nearest dealer. Bus fleets generally operate their own repair facilities.

The entire maintenance picture will get a fresh look at the second session at the Annual Meeting sponsored by the Transportation and Maintenance Committee. C. C. Hudson, of the Tennessee Valley Authority, will air the pros and cons of "Fast Replacement Versus Heavy Maintenance."

The T & M Committee feels the subject will draw plenty of fire in the way of discussion. That's because new thinking is emerging on commercial vehicle operations. Men in the transportation business are saying that their aim is to move goods, provide services at lowest costs. Maintaining, repairing, and servicing the vehicle is a necessary evil, they feel. So going light on the maintenance services and replacing the vehicle when it's worn will leave you with dollars ahead in the long run.

There are a good many operators who don't go along with this thinking. So "Charlie" Hudson's paper is a sure bet to trigger a sessionful of conflicting opinions. The Committee has set up the program to allow enough time for anyone who has thoughts on the problem to have his say.

LEAD-CHASER . . .

. . . merits to be reported at Annual Meeting.

DOES service experience confirm the value of tricresyl phosphate as a deterrent to spark-plug lead fouling? Red-hot dope on this is just one of five packages of information the F&L Activity Committee plans to beam at

audiences at its two 1953 Annual Meeting sessions.

Other treats in store for F&L-minded engineers who attend these Friday, Jan. 16, sessions are descriptions of a new way to identify preignition and a laboratory engine test for evaluating low temperature, sludge-handling ability of motor oils. Memories will be jogged and brought up to date, too, on the effect of diesel fuel consumption on smoking and odor.

Of interest to many will be a paper analyzing the economics of stock cars —from an engineer's viewpoint.

Presentation of the Horning Memorial Award to Du Pont's L. F. Dumont will highlight the afternoon session.

VIDEO . . .

. . . session entails heavy planning, complex facilities, and many people.

WHEN the SAE Truck & Bus Activity agreed to sponsor the Annual Meeting session featuring a paper by L. W. Fischer and a television show on Timken's new indoor proving ground, it set people into motion across the country. Here are some of the things that started to happen:

• In Detroit Larry Fischer began preparing his paper "How a Proving Ground Was Moved Indoors," after accepting the invitation from T & B Chairman F. W. Kateley, from Philadelphia.

• Army Ordnance was contacted for its motion picture on testing military vehicles on the outdoor proving ground at Camp Bullis, Texas. The film will be shown at the SAE session.

• General Electric's E. B. Stavely, Jr., started to ready his remarks on GE's participation in design of the new equipment.

• TV specialists from New York and Detroit undertook a survey of meetings facilities in Detroit to find a room best suited to handling a theatre-size television screen and the necessary equipment. (The auditorium in the Rackham Educational Memorial Building has been selected as the meeting site.)

• The TV screen and proper transmitting and receiving equipment needed for transmitting from the Timken plant to the session hall had to be located in Detroit.

• Roy W. Roush, Timken's chief materials engineer, was asked to serve as a discusser on the program.

Both the Radio Corp. of America and Michigan Bell Telephone have reported that the live television transmission of the equipment demonstration from the Timken plant to the Rackham auditorium is practical. The presentation will be sent by microwave from the roof of one of the Timken buildings to the tower of the Michigan Bell Telephone Building, then relayed to the Rackham Building.

This isn't as simple as it sounds. Myriads of technical problems have to be coped with by the television people. RCA will bring a crew of 12 technicians from New York and Bell Telephone will have three or four technicians. From what Larry Fischer has seen of the planning on the telecasting phase of the program, he says "this really is quite a project, in fact as complicated as producing a big show."

PLANS . . .

. . . for Annual Meeting sessions already settled by Diesel-Engine Activity.

ARRANGEMENTS for the two diesel-engine sessions to be held at the 1953 Annual Meeting have been completed. Such was the accomplishment of the Diesel-Engine Activity Committee at a meeting held on October 30, during the SAE National Diesel-Engine Meeting. F. A. Robbins, vice-chairman of the activity, was chairman of this meeting.

Possible subjects for discussion at the 1953 SAE Summer Meeting Round Tables and suggested papers for the diesel-engine session were also reviewed.

Body Activity Plans January Sessions

FINAL details for its sessions at the Annual Meeting next January recently were buttoned up by the SAE Body Activity Committee. Facing the camera above are Chairman V. M. Exner (left) and Meetings Vice Chairman H. E. Chesebrough, who led the group's meeting. Final plans were made for one session on reinforced plastic car bodies (SAE Journal, Oct. 1952, p. 93) and another on commercial body engineering.

Chairman of the session, J. W. Greig, Woodall Industries, reports that several attractive features are being added to the program. A demonstration will be given on how glass-reinforced plastic parts are made. Current production processes will actually be duplicated. To give design engineers an indication of the cost of reinforced plastic parts of varying complexity, actual commercial products made of the material—each bearing a price tag —will be on display at the session room.

The technical program will consist of the following:

• A paper entitled "Fiber-Glass. . . . What Has This to Do with Bodies?" by Games Slayter, Owens-Corning Fiberglas.

• A paper entitled "Problems, Production, and Technique of Laminated Fiber-Glass," by I. N. Scott, Winner Mfg. Co.

• A panel of specialists on resins and fibrous glass to answer questions from the floor.

The second session sponsored by the Activity at the Annual Meeting will feature the paper "Commercial Body Engineering Today," by E. P. Lamb, chief engineer, Truck Division, Chrysler Corp.

The SAE Passenger Car Activity Committee met recently to complete its share of the Annual Meeting program. Facing the camera at the head of the table are Harold Nutt, (left) meetings vice-chairman, and H. E. Churchill, vice-president for the Activity

NEW V-8 . . .

. . . by Buick featured on Annual Meeting program by Passenger Car group.

THE 1953 SAE Annual Meeting will record another milestone in the race among American car makers to build better engines. Details of the new Buick V-8 engine will be unveiled by V. P. Mathews, Buick's chief engineer, and Joseph Turley.

Such alert programming is a continuing goal of the SAE Passenger Car Activity Committee. This group aims to keep automotive engineers informed by bringing to the Society papers on new passenger developments just as they reach the market.

The Committee achieved its objective in scheduling SAE meetings on a host of postwar car engines . . . the Oldsmobile Rocket, the Studebaker V-8, the Cadillac V-8, Chrysler's Fire-Power, and Ford's recent "six."

SAE also has landed a paper on each new automatic transmission as it made its debut.

The keen competition in industry in engine design assures standing-room-only crowds for this session. Judging by past performance at new passenger car development sessions, spirited discussion also is a pretty sure bet at this session.

GUARDS . . .

. . . against surface wear to be disclosed by five-man panel at Annual Meeting.

GENERALITIES on how to prolong the life of wearing surfaces are a dime a dozen. But specific answers on what to do with a given bearing, bushing, or gear set are hard to come by. Such problems will be taken apart at an Annual Meeting symposium on surface treatments to prevent wear, sponsored by the SAE Engineering Materials Activity Committee.

M. F. Garwood, meetings vice-chairman for the Committee, reports that five specialists on wear prevention will dish up the latest information on treatments for ferrous and nonferrous surfaces. Here is the way the program shapes up:

- Walter Jominy, of Chrysler, will start the session rolling with a resume of current wear theories and some concepts on what happens when surfaces wear.
- R. H. Bancroft, Perfect Circle Corp., will tackle ferrous surfaces. He will compare various platings and coatings.
- Alcoa's R. V. Vanden Berg will bring an up-to-date picture of wear prevention with aluminum.
- Newly developed wear resistant coatings for magnesium will be disclosed by Earl Shaper, of Dow Chemical.
- J. F. Kunc, Jr., Standard Oil Development, has agreed to talk about the role of lubricants in wear prevention.

M. F. Garwood

Garwood promises that there will be ample time for discussion. Any engineer with a troublesome wear problem will be able to bounce it on these specialists.

SAE Finance Committee Meets

Most recent meeting of the SAE Finance Committee was held in Philadelphia. SAE Treasurer B. B. Bachman was host to the group. Chairman A. T. Colwell air-taxied other members back and forth from Detroit in Thompson Products' DC-3. The Committee's full membership was present.

They are (left to right): George Delaney, Pontiac Motor Division, GMC; Chairman A. T. Colwell, Thompson Products, Inc.; Walter F. Rockwell, Timken-Detroit Axle Co.; B. B. Bachman, Autocar Co.; and J. C. Zeder, Chrysler Corp.

TITANIUM . . .

. . . symposium arranged for aircraft men January 16 in Detroit.

HIGH strength/weight ratio, flame resistance, and other properties of titanium will be discussed in a five-paper symposium planned for Friday morning, January 16, the last day of the SAE Annual Meeting.

The five papers in the symposium are:

"Production and Properties of Titanium and Titanium Alloys" by C. I. Bradford of Rem-Cru.

"Titanium Alloy Development" by Max Hansen of Armour Research Foundation.

"Utilization of Titanium and Other Alloys in Corrosive Environments" by W. Lee Williams of the U. S. Naval Engineering Experiment Station.

"Fabrication and Utilization of Titanium in the Aircraft Engine Industry" by L. A. Frazier of GE's Thompson Laboratory.

"Titanium in Airframes" by Francis R. Kostoch of North American Aviation.

J. B. Johnson of the Wright Air Development Center has accepted the SAE Aircraft Activity's invitation to preside over the symposium.

NODULAR IRON...

. . . wheres and whys to be aired at Annual Meeting.

AUTOMOTIVE engineers can find out more about the where-to-use and whys of nodular iron at the Annual Meeting on Jan. 13. There, at a Tractor and Farm Machinery session, they'll learn what tractor and automotive equipment parts are now being made of this material—and why.

What's more, after hearing a trio of papers on this subject and citing their own experiences, they'll get a chance to hear about latest industrial and agricultural uses for aircooled engines. Foreign aircooled engine design and developments are slated to be revealed, too.

International Harvester's C. A. Hubert will wield the gavel at this Tuesday afternoon session.

Beecroft Award to Kreml

Franklin M. Kreml (second from left) receives the 1952 Beecroft Memorial Award from SAE Past-President James M. Crawford, (second from right) chairman of the Award Committee. Standing at the left is Emil Bugnon, president of the International Association of Chiefs of Police and at the right, W. H. Parker, Los Angeles Chief of Police

BEECROFT . . .

. . . Award is presented at IACP Annual Meeting in L.A.

FORMAL presentation of the Beecroft Memorial Award for 1952 to Franklin M. Kreml was made by SAE Past President James M. Crawford, chairman of the Award Committee, on Sept. 24 at the annual meeting of the International Association of Chiefs of Police. The meeting was held at the Biltmore Hotel, Los Angeles.

Announcement of Kreml as 1952 Beecroft Memorial Award Lecturer was made in the August SAE Journal (p. 75). Kreml's lecture, "Traffic Law Enforcement" was presented on Oct. 21 at the National Safety Congress at the Congress Hotel in Chicago—and is printed in full on pp. 36 to 47 of this issue. He is director of the Traffic Institute of Northwestern University and of the Traffic Division of the IACP.

Making the presentation, Crawford noted that it was the sixth in the series of ten such awards to be made under the terms of the will of SAE Past President David Beecroft to men who have made outstanding contributions to safety on the highways.

The conditions under which the award is granted, Crawford noted, require only that the recipient write a lecture on that segment of the safety work with which he has been identified. "The monographs which have resulted," Crawford said, "have proved to be of great significance in the fields of public support, highway administration, traffic court procedures, research, and motor vehicle administration. As a result, the SAE Past Presidents Advisory Committee has approved a recommendation from the Beecroft Memorial Award Committee that, in the future selection of candidates, a conscious effort should be made to produce documents of similar value on such other outstanding phases of enforcement as public information, education, engineering, and accident records."

Kreml received the 1952 Award, Crawford said, "in recognition of a great public service."

YOU'LL . . .

. . . be interested to know about these SAE people and events.

GEORGE DELANEY, Pontiac's chief engineer, has been selected by SAE President D. P. Barnard as SAE nominee to serve as a director of the American Standards Association for a term of three years, beginning Jan. 1, 1953. . . . President Barnard has also named Delaney a member of the SAE Finance Committee, from which SAE Past-President J. M. Crawford resigned, following his retirement from General Motors Corp.

THE SOCIETY'S ANNUAL BUSINESS SESSION will be held on Jan. 13, 1953, (Tuesday of Annual Meeting Week) as has been the practice for a number of years.

* * *

AT PENNSYLVANIA STATE COLLEGE, SAE has a new Student Branch. Charter was granted to the Student Club which has been operating successfully there for several years. SAE Council took the action at its Oct. 2 meeting in Los Angeles.

* * *

HERBERT HAPPERSBERG has been named SAE representative at the 23rd Annual Safety Convention and Exposition, March 24-27, 1953.

E. S. MacPHERSON of Ford and W. G. LUNDQUIST of Wright Aero have been reappointed to serve another term as SAE-nominated Directors of the Coordinating Research Council. Their new two-year terms expire Dec. 31, 1954. Appointed as the third SAE-nominated CRC Director for this two-year term beginning next January is L. L. Bower of Waukesha.

* * *

NEIL BURGESS of General Electric has become a member of the Aircraft Powerplant Activity Committee . . . and to the Passenger Car Activity Committee has been added C. W. FREDERICK of Chevrolet . . . and N. P. MOLLINGER of Ladish has accepted membership on the Production Activity Committee.

NATIONAL MEETINGS

Meeting	Date	Hotel
	1953	
ANNUAL MEETING and ENGINEERING DISPLAY	Jan. 12-16	The Sheraton-Cadillac, Detroit
PASSENGER CAR, BODY, and MATERIALS	March 3-5	The Sheraton-Cadillac, Detroit
PRODUCTION	March 25-27	Hotel Statler, Cleveland
AERONAUTIC and AIRCRAFT ENGINEERING DISPLAY and AIRCRAFT PRODUCTION FORUM	April 20-24	Hotel Governor Clinton, New York City
SUMMER	June 7-12	The Ambassador and Ritz-Carlton, Atlantic City, N. J.
INTERNATIONAL WEST COAST	Aug. 17-19	Georgia Hotel, Vancouver, B. C.
TRACTOR and PRODUCTION FORUM	Sept. 14-17	Hotel Schroeder, Milwaukee
AERONAUTIC and AIRCRAFT ENGINEERING DISPLAY and AIRCRAFT PRODUCTION FORUM	Sept. 29-Oct. 3	Hotel Statler, Los Angeles
INTERNATIONAL PRODUCTION	Oct. 29-30	Royal York Hotel, Toronto
TRANSPORTATION	Nov. 2-4	Conrad Hilton, Chicago
DIESEL ENGINE	Nov. 3-4	Conrad Hilton, Chicago
FUELS & LUBRICANTS	Nov. 5-6	Conrad Hilton, Chicago

Programs for ASME's

Air Cargo Day*—Dec. 1 and Symposium: Heavy Forgings and Extrusions for Modern Aircraft**—Dec. 2

To be held at the Hotel Statler, New York, N.Y., with SAE as one of the co-sponsors

Air Cargo Day* — Monday, Dec. 1

9:30 a.m. Skytop

Panel on Air Cargo Terminal Requirements
Chairman—**C. W. Meldram**
Vice-Chairman—**James M. Bright**

The Civil Aeronautics Administration's Views
Phillip Hahn, Civil Aeronautics Administration

The Airport Operator's Viewpoint
Thomas M. Sullivan, Port of New York Authority

The Air Cargo Transport Manufacturer's Views
Herman Olson, Douglas Aircraft Corp.

The All-Freight Operator's Views
R. Edward Hembree, Flying Tiger Line

The Combination Passenger/Air-Freight Operator's Views
Frank W. Jones, American Airlines, Inc.

2:30 p.m. Skytop

Symposium on International Air Cargo Trends
Chairman—**Alvin P. Adams**
Vice-Chairman—**Don Buck**

Air Freight Development in Australia
Ian H. Grabowsky, Australian National Airways

Air Freight Development in Europe
D. SJ. De Boer, **KLM**—Royal Dutch Airlines

Transatlantic Air Freight Development in Relation to Air Logistics
Carl D. Breil, Seaboard & Western Airlines

8:00 p.m. Skytop

Symposium on Air Transportability
Chairman—**Brig.-Gen. William T. Hudnell**, USAF
Vice-Chairman—**John R. Alison**

Air Transportability in the Fleet Logistics Air Wing
Capt. Joseph I. Taylor, USN

Air Transportability with Troop Carrier
Maj.-Gen. Robert W. Douglass, Jr., USAF

Air Transportability with M.A.T.S.
Lt.-Gen. Joseph Smith, USAF

Air Transportability Capabilities of the Commercial Air Freight Carrier
Thomas L. Grace, Slick Airways, Inc.

* Sponsored by the American Society of Mechanical Engineers, the Institute of the Aeronautical Sciences, the Air Cargo Task Committee of the National Security Industrial Association, and the SAE.

Symposium:** — Tuesday, Dec. 2

Heavy Forgings and Extrusions for Modern Aircraft

9:30 a.m. Skytop
Chairman—**C. C. Furnas**
Vice-Chairman—**Dr. T. A. Reed**

Requirements for Large Forgings and Extrusions in the Aircraft Industry
George W. Papen, Lockheed Aircraft Corp.

The Design and Construction of Large Forging and Extrusion Presses for Light Metals
Dr. Morris Stone, United Engineering and Foundry Co.

Metallurgy and Production of Suitable Aluminum Alloy Ingots for Large Forgings and Extrusions
Thomas L. Fritzlen, Reynolds Metals Co.

2:30 p.m. Skytop
Chairman—**Dr. William O'Donnell**
Vice-Chairman—**I. C. Peterson**

Large Forging Press Operations and Production Problems
George Motherwell, Wyman-Gordon Co.

The Large Extrusion Press and Its Production Problems
T. F. McCormick, Aluminum Co. of America

** Sponsored by the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the Institute of the Aeronautical Sciences, and the SAE.

TECHNICAL COMMITTEE *Progress*

1952 SAE Technical Board

G. A. Delaney, Chairman
P. C. Ackerman
B. B. Bachman
H. W. Browall
R. D. Kelly
R. P. Kroon
R. P. Lansing
R. P. Lewis
W. G. Lundquist
E. S. MacPherson
A. F. Meyer, Jr.
M. E. Nuttila
F. N. Piasecki
R. J. S. Pigott
F. W. Tanquary
W. M. Walworth
W. H. Worthington

Lesson in Parts Interchangeability Taken From Military Gasoline Engines

INTERCHANGEABILITY of key components of earthmoving machinery can save money and time for contractors in the field. That's why the SAE Construction and Industrial Machinery Technical Committee is now developing standards along these lines. At a recent CIMTC meeting in Milwaukee, Committee members learned that a similar program, undertaken about five years ago by the Corps of Engineers, reduced by 95% the number of high mortality parts in industrial engines. (See chart.)

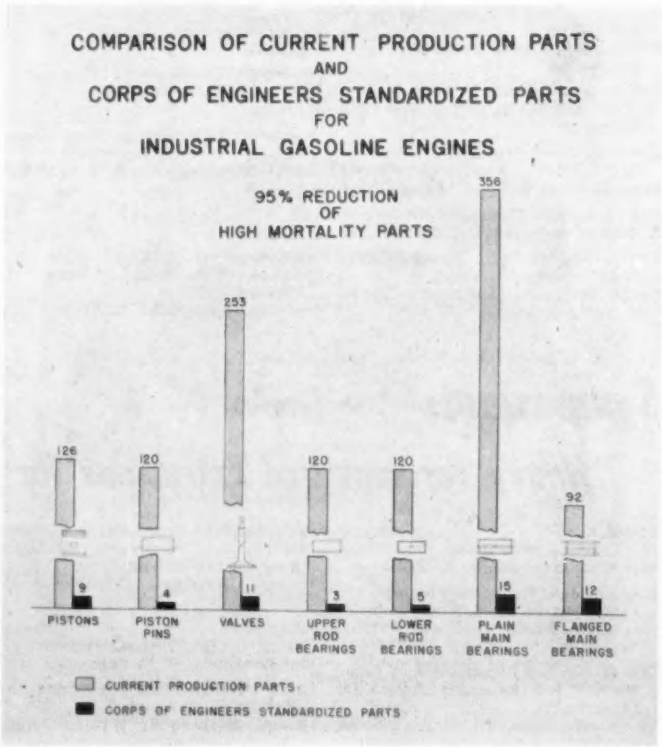
These engines are used in military equipment such as portable electric generator sets, air compressors, cranes, tractors, and road rollers. These engines are required by current procurement specifications and will be in production shortly.

R. W. Beal, chief, mechanical group, Engineer Research and Development Laboratories, Fort Belvoir, told the group that World War II taught the military a lesson. The tremendous maintenance and spare parts problems took an unnecessarily large part of the total war effort. The military services realized that they had to do something to make better use of the engine industry in future emergencies.

That thinking led to the request by the Munitions Board that an effort be made to standardize industrial engines used by the Army, Navy, and Air Force. The Corps of Engineers got the job.

As the chart shows, here are the results:

• Production engines, having 19 dif-



ferent bore diameters in the range of 2⅞ to 4⅛ in., were consolidated into five basic bore sizes.

- Pistons were reduced from 126 to 9.
- From 253 to 11 was the reduction in valves.
- The number of plain main bearings was cut from 350 to 15.
- The total reduction in such parts was 1187 to 59, or 95%.

Recently the Engineer Research and Development Laboratories entered another phase of the Munition Board's engine standardization program. It's going into engine accessories, concentrating on generators, air cleaners, and fan belts. An SAE subcommittee under CIMTC has been working on standards for 24-v battery generators and is cooperating with the military group in this program.

New and Revised AMS's Conserve Scarce Alloys

THE aircraft industry's effort to minimize demand for scarce alloying elements has been bolstered by 33 new or revised alloy-conserving Aeronautical Materials Specifications. AMS Division Chairman J. B. Johnson reported this fact to the Division's parent body, the SAE Aeronautical Committee at its meeting in Los Angeles on Oct. 1.

Twenty-five specifications for columbium-tantalum alloy steels were revised to call for columbium-tantalum ratios of 60/40 instead of the previous 90/10. Impetus for this change was the estimate of columbium producers that 25% more columbium would be available for high-temperature alloys if proportionately more tantalum could be used with the columbium. The change was made only after users on the AMS Division's special panel on columbium checked the new compositions in their laboratories and shops and concluded that engine and airframe applications would not suffer from the change, Johnson explained.

Five new specifications for low-alloy nickel-chrome-boron steels, he continued, reduce nickel requirements approximately 50% from those of the steels they replace.

Three more recently published AMS's cover a 25%-chromium, 10%-nickel alloy which can replace 25%-chromium, 20%-nickel alloys in many applications. Drafts of these specifications were circulated to the AMS Division and approved by it with corrections, re-edited, circulated to the SAE Aeronautical Committee and SAE Technical Board and approved by them, and released for distribution—all within three months. Johnson cited this case as an example of the speed and thoroughness with which SAE works on standardization projects.

Specifications for high-temperature cobalt alloys containing less than the usual amounts of cobalt are also under development by the AMS Division, Johnson reported.

All these measures, it is hoped, will help aircraft gas turbine producers live within this country's critical materials budget now and in possible future full-mobilization periods. According to Johnson, the United States' current annual share of the four most critical alloying elements is: 9,000,000 lb of columbium, 256,000,000 lb of nickel, 16,000,000 of cobalt, and 350,000,000 lb of chromium.

AMS Division Chairman Johnson is with the USAF's Air Development Center.

J. B. Johnson

New Shipping Wraps for Delicate Aero Equipment

TEN years ago, packaging engineers were asked to come up with ways to eliminate corrosion, and mold and fungus deterioration in military packaged items—and they did! Today, the squeeze is on them again. But this time the cry is for better packaging protection for delicate equipment against shock and vibration in transit. And, as was the case before, SAE has been asked to tackle this problem.

Already the wheels are turning. At its initial meeting in New York on Sept. 17, a Shock and Vibration Isolation Committee set up its goals and mapped out the program needed to attain them. The group which will function under the supervision of the SAE Aeronautics Committee, decided that it should channel its work toward:

- Division of all instruments, electronic gear, and similar fragile items into groups based on fragility.
- Development of simple formulas, nomographs, and procedures for determining the proper amount and type of cushioning material for adequate and economical shock and vibration protection.

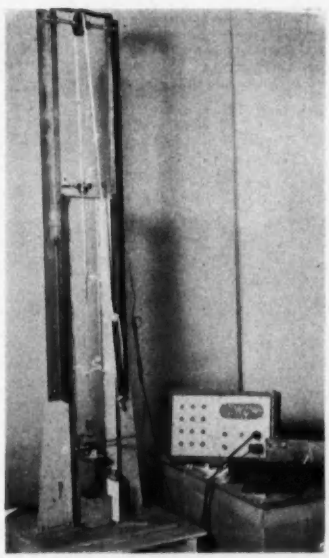
As brought out at the meeting by Capt. J. E. Arnoult, of Wright Air Development Center's Packaging Branch, survival of packaged equipment depends on container cushioning materials and the characteristics of the items being shipped. Thus, it's important to separate instruments and electronic gear into fragility groups. Packaging can then be designed which will satisfactorily protect each group.

Knowing the proper amount and type of packaging material obviously is a must too. If type of cushioning material is not properly chosen, the resulting package may be larger than necessary and still not offer sufficient protection. Therefore, a few basic rules on proper use of packaging materials would really be a boon to the military.

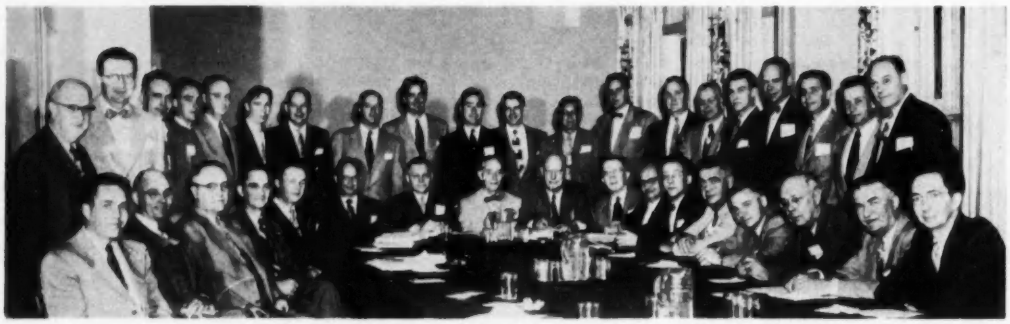
With these goals in mind, the committee laid the groundwork that may lead to them. It set up two subcommittees, one to determine what basic information is necessary for the study; the other to investigate current shock and vibration test procedures.

Appointed to serve on the first subcommittee were W. H. Skidmore, Weston Electrical Instrument; J. L. Krager, RCA; and H. M. Brady, of Chatham Electronics. Serving on the second are H. J. Wenborn, General Electric; H. F. Ames, Sylvania Electric Products; and S. Roman, of Motorla.

Foster D. Snell's Marvin Masel is temporary chairman of this Shock and Vibration Isolation Committee.

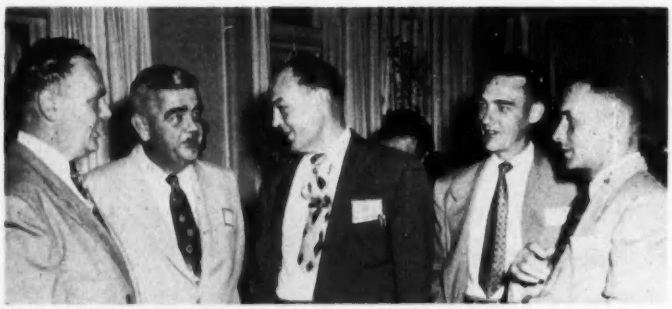


Packaging sensitive aeronautic equipment raises knotty problems for the industry. The Signal Corps, too, faces a similar job with its electronic assemblies. This is one of the machines it uses to test cushioning materials used for packaging



Thirty-seven of the 40 men attending Division XX's meeting Sept. 24-26 at the Homestead, Hot Springs, Va.

Shot Peening Group Meets at Hot Springs



SHOP TALK between sessions occupies K. H. Barnes of American Wheelabrator, W. L. R. Steele of McInerney Spring and Wire, J. C. Straub of American Wheelabrator, and Howard Ripper and J. R. McConnell of Pittsburgh Crushed Steel

DISCUSSIONS of shot peening and blast cleaning resounded through the Homestead at Hot Springs, Va. Sept. 24-26. The discussors were there for the annual three-day meeting of Division XX—Shot Peening of the SAE Iron and Steel Technical Committee.

They participated in a round-table on "Fine Particle Blasting," whose principal contributors were W. I. Gladfelter of Pangborn, E. E. Brodhag of American Wheelabrator, Verne W. Nichols of Vapor Blast, and E. E. Hawkinson of Microblast. H. H. Miller presented a paper on shot peening coverage that he and P. H. Flynn had prepared on the basis of their experience and studies at Buick. Information from both the round table discussion and the paper will be featured in later issues of SAE Journal.

Speaker at the Thursday evening dinner meeting was R. E. Peterson of Westinghouse, who talked on "Some Topics in Fatigue Analysis."

MEETINGS brought participants up to date on Division XX's work. R. L. Mattson (standing) of GM presided. Others facing camera are R. C. Sackett of the SAE staff, N. S. Mosher of Alloy Metal Abrasives, and H. H. ZurBurg of Chrysler

Reports Discussed

Discussion in sessions of the Division and some of its subcommittees brought out that:

- SAE Blast Cleaning Manual—To develop data on life expectancy of blasting-machine blades, a wear test program has been initiated by the Blast Cleaning Subcommittee. Test results are to be incorporated in the SAE Blast Cleaning Manual if they are available soon enough.

Other sections drafted or planned for the manual include descriptions of

the blast cleaning process, blast cleaning machines, and abrasives.

● Test Strips—Possibly tolerances on SAE standard shot peening test strips can be tightened. The test strip subcommittee planned a test program to find out.

D. A. Cargill of Precision Shot Co. has found a source of strip believed to be rolled to the needed uniformity. H. J. Noble of Pratt & Whitney Aircraft reported that strips procured via Cargill from this source test consistently within the hardness range of 46–48 Rockwell C and exhibit satisfactory flatness. The Test Strip Subcommittee hopes to determine from its projected tests on this material what requirements can be written into a specification for test strips.

F. P. Zimmerli of Barnes-Gibson-Raymond offered to heat-treat a quantity of the new test strips and distribute them to J. C. Straub of American Wheelabrator, R. L. Mattson of GM Research, and H. H. ZurBurg of Chrysler for hardness and flatness determinations. Their results are expected to help the Subcommittee in deciding whether to revise test-strip requirements.

● Shot Quality Testing—Mattson-Cargill shot-testing machines give remarkably uniform results, it was reported. The Mattson-Cargill machine is the machine Division members agreed a year ago to study with the idea of considering its suitability as a standard production shot tester. Five of the machines have been in experimental use during the past year, and testing is to continue.

● Shot Peening and Blast Cleaning Bibliography—Thirty-five articles published between January 1950 and May 1952 have been abstracted. Capt. E. J. Ward of Wright-Patterson Air Force Base offered the services of the Armed Services Technical Branch in translating and abstracting certain Russian articles which Bibliography Subcommittee Chairman ZurBurg has collected. F. P. Zimmerli offered the Subcommittee copies of all Barnes-Gibson-Raymond's abstracts on the subject.

● Refusal to Specify Shot Chemistry—Division members voted down a proposal to investigate possibility of specifying chemical compositions of all kinds of shot. Opponents of the proposal contended that shot properties depend so much on heat-treatment and other processing that specifying chemical composition is no guarantee of shot quality.

R. L. Mattson of GM Research Laboratories is chairman of Division XX. He presided at the Division's working sessions as well as at the Thursday evening dinner meeting at which R. E. Peterson spoke.

25 Years Ago

Facts and Opinions from SAE Journal of November, 1927

A new section publication—the Detroit Super Charger—made its appearance in October. This new "messenger" will be busy every month from now on carrying announcements and news of the Section to Detroit Section members.

■

The air cooled engine is more reliable, more adaptable to extreme temperatures, easier to maintain and overhaul, lighter, and more suited to economical airplane operation than the watercooled engine. It is the foundation on which commercial aviation will be built.—C. H. Biddlecombe in Aeronautic Meeting paper.

■

At the last meeting of the SAE Lubricants Division, it was voted to retain the SAE system of viscosity numbers as it stands, and to determine a suitable means for putting it into wider use.

■

Increased demand for brake linings with more uniform coefficients of friction has led to renewed efforts to produce such material. Claims of results achieved in this direction have not been substantiated.—S. von Ammon, Bureau of Standards, in Semi-Annual Meeting paper.

■

The best way to sell the public on commercial aviation is to provide an airport that people can visit regularly and be glad to do so. New York City, with all its wealth and millions of people, certainly can afford to pay the price for an airport in the metropolitan area. By so doing, the City would serve commercial interests, foster prosperity, and at the same time strengthen national security.—W. P. MacCracken, Jr., assistant secretary of commerce for aeronautics, at Metropolitan Section Meeting.

Keeping truck-operating cost records is a simple matter when all cost factors can be recognized and classified. It is carelessness in the consideration of these factors that leads to difficulty. This is especially true with overhead or burden items.—A. W. Herrington in Transportation Meeting paper.

■

Navigation and aircraft instruments today are far from perfect. Experimenters, however, are constantly trying to develop better devices. It will be extremely helpful toward this end if aviators will relate their experiences and offer constructive criticism.—V. E. Carbonara, Pioneer Instrument Co., in Aeronautic Meeting paper.

■

Metal construction of aircraft is a great improvement over wood construction. Its success, however, depends upon eliminating corrosion. This means that engineers must design so that all parts are readily accessible. If closed sections cannot be avoided, they must be thoroughly cleaned, covered internally with protective coating, and adequately sealed.—Com. R. D. Weyerbacher, U. S. Navy, in Aeronautic Meeting paper.

■

The wind tunnel has been an indispensable aid to aeronautical progress, but these two defects in the technique of wind-tunnel testing have yet to be overcome: (1) aeronautical engineering coefficients derived from wind-tunnel tests of small-scale models often require correction for scale effect before they can be applied to full-scale designs, (2) results obtained from different wind-tunnel tests do not always check.—E. N. Fales in Aeronautic Meeting paper.

SAE Section Meetings

Milwaukee Golf Party Pulls 'Em Out Again

• Milwaukee Section

Sept. 12—Over 230 tractor and farm machinery engineers and suppliers went to Tripoli Country Club to battle par at the Milwaukee Section's Annual Golf Party. There, this throng—many of whom had just attended the tremendously successful Tractor Meeting—shed their slipsticks for golf sticks, took no note of engine-killing dust they raised in sand traps, and thought only in terms of another kind of efficiency—par.

A few of these golf enthusiasts broke par more often than it "broke" them; most were not so lucky.

Dick Strickland, of Bower Roller Bearing Co., with a scorching 72 walked off with top honors. His brother, Russell Strickland, Bower's V.P. of Sales, was a close second with a 73. And Clem Jensen, of Borg-Warner's Mechanics Universal Joint Division, pulled up third with a putt-heavy 75. Jensen, however, may putt better at future outings for he was awarded a new putter for being closest to the pin on the 185 yd third hole.

These weren't the only **outstanding** performances rewarded with prizes though. L. W. Kibbey, of Sealed Power Corp., managed to win the Paul Bunyan club for a screeching 7½ yd drive. And another stouthearted individual—better unnamed—achieved a 222 score. For this supreme endeavor, he won the Milwaukee Section Loving Cup—a not too beautiful trophy.

Altogether eleven golfers received appropriate mementos for their singular achievements. But they were far from being the only ones who walked off with loot. Later at the jam-packed dinner, 174 more prizes were drawn by many of the 256 in attendance. Radios, batteries, leather goods, tires, golf balls—these were just a few of the gifts they acquired.

Credit both for collecting this raft of bounty from Milwaukee concerns and for the outstanding success of this ever-popular annual event goes to Golf Chairman George A. Rea, of Heil Co.

Two of the 236 golfers who turned out for the Milwaukee Section Golf Party were Massey-Harris' L. S. Pfost (left) and L. C. Evans (right)

Stressed Aluminum Skin Makes Strong, Light Trailers

• Northern California Section
J. A. Miller, Field Editor

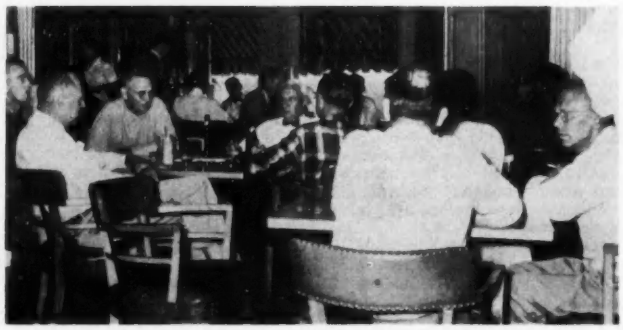
Sept. 24—Sponsored by the Transportation and Maintenance Activity, the opening session of Northern California Section was chairmanned by J. V. DeCamp of Norton Truck Co., who introduced **K. W. Tantlinger,** vice-president and chief engineer of Brown Trailers, Inc.

Tantlinger discussed "Aluminum Stressed Skin Construction for Light Weight Highway Semi-Trailers." He emphasized the importance of the subject by pointing out that truck-trailer business is now so large that approximately one family in eight depends upon this industry, directly or indirectly, for its livelihood.

Discussing primarily weight-saving features and strength, he stated that the former practice in trailer construction of covering a steel frame with unstressed aluminum sheet had many drawbacks: abrasion, galvanic corrosion and rubbing which destroyed insulation. These were overcome by using stressed sheets over an extruded frame of monocoque design, and aluminum has been found to be the best metal for this use. It is safe, economical, light and easy to maintain. The light weight is indicated by the fact that the structural frame across the top edge of a van weighs only 1.8 lb per linear foot, and that a standard van "box" of 8 ft by 8 ft cross-section weighs only about 100 lb per foot of length including insulation.

Safety is illustrated by records showing that in accidents there is much less spillage of cargo on highways, or of cargo breaking through the front of the van into the tractor cab.

Strength is illustrated by the case of one operator who has used these heavily loaded van boxes between



The nineteenth hole proved to be quite an attraction

Seattle and Alaska by hoisting complete units on to open barges. They have withstood these heavy stresses of loading and the corrosive atmosphere for three years and are still in use.

Other applications for this type of construction are: (1) airborne refrigerator units for the army, which must withstand drop tests, and (2) large refrigerated boxes for produce, which are stacked three deep in holds of ships. Boxes are given no external support, yet show no deflection of walls.

Tantlinger concluded by saying that the present trend in van construction is to further reduce weight by replacing many parts of wheel and axle assembly with lighter weight construction. Replacing oak floors of van by corrugated aluminum saves two pounds per square foot. He also said that since trailers receive very little maintainence in operation, they must go many thousand miles without lubrication. This can be accomplished by use of "Torsilastic" springs, using coaxial rubber bushings which require no lubrication.

At the season's first meeting for Central Illinois Section, C. G. A. Rosen of Caterpillar discussed some of the problems of diesel engine design. Left to right: T. M. Fahnestock, who was technical chairman of the meeting; Section Chairman John T. Liggett; and T. M. Logan, who described his impressions of post-war Germany in a coffee talk

Diesel Engine Combustion Presents Unsolved Problems

• Central Illinois Section

R. F. Hughes, Field Editor

Sept. 29—**C. G. A. Rosen** of Caterpillar Tractor Co. delivered the first paper of the current season to 165 members and guests of the Central Illinois Section. His topic for the evening was "Some Unsolved Problems in Diesel Engines, a Survey of the Combustion Chamber Envelope." Rosen pointed out that a very large number of questions regarding diesel engine combustion remain unanswered in spite of the number of research organizations devoted to developing better engines. The fact that four different combustion systems are currently being used by engine manufacturers, no one of which incorporates the major advantages of the other three, is an indication of the need for additional knowledge of the diesel engine combustion processes.

Rosen showed slides of both the open and the precombustion chamber type of combustion systems and described in detail some of the phenomena that occur in each type during the combustion cycle. He also pointed out that in the development of high output diesel engines, too much effort has been directed toward getting air into the cylinder and too little to the problem of heat extraction to critical parts and to the lowering of the inherent losses. As an example, an M.A.N. engine was cited, whose output was increased 300% with only a 30% increase in heat transfer through the combustion chamber and piston rings.

In conclusion, Rosen listed four of the unsolved problems of the diesel engines:

1. Mixture formation, in which each fuel particle is to be prepared for combustion as quickly and conveniently as possible.
2. The need of more definite control of heat extraction from the combustion chamber envelope.
3. Need of more knowledge of distortion control to give added life to engine parts.
4. Need of a supercharger pre-eminently matched to diesel field operating conditions.

T. M. Fahnestock, technical chairman of the evening, introduced the after-dinner speaker, Tom Logan, who discussed "Impressions of Post-War Germany."

Describes Features Of New Ford Engines

• Milwaukee Section

P. S. Myers, Field Editor

Oct. 3—**P. M. Clayton** of the Ford Motor Co., accompanied by V. G. Raviolo and Robert Stevenson, Jr., of Ford, explained to a crowd of 250 engineers the changes, improvements and advantages of the new line of Ford and Lincoln overhead valve engines. He pointed out that 100,000 engineering man-hours, 50,000 hours of dynamometer testing, and 500,000 test miles went into the development of each of the engines.

The engines feature overhead valves and a more nearly "square" engine with consequent higher permissible compression ratio, better breathing, less heat rejection to cooling water, less friction horsepower and a stiffer crankshaft and engine. Experimental data were presented to show that each one of these desirable features and improvements were obtained in the new Ford engine and resulted in a better-performing engine with a lower fuel rate.

The new Ford and Lincoln engines have numerous desirable features other than those achieved by overhead valves and a short stroke, Clayton continued. These features include a special alloy iron crankshaft with excellent endurance limits and damping characteristics and requiring only finish machining, a crankcase parting line below the center line of the crankshaft for ease of mounting and increased engine rigidity, no head bolt bosses on the cylinder walls, fuel-flow oil filtering, valve rotators, silent chain camshaft drive and full pressure lubrication.

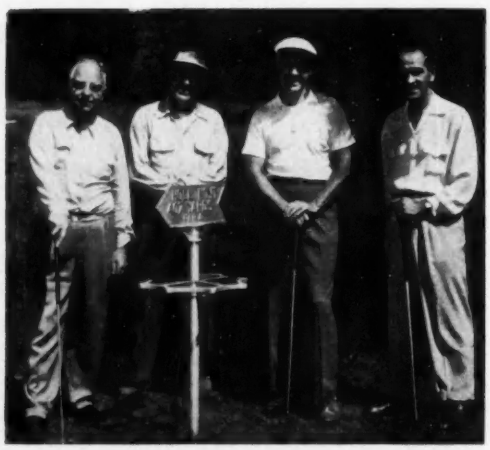
A lively question and answer period brought out other interesting engine features, such as that the piston pin was offset slightly to reduce piston slap; that valve rotators made valve inserts unnecessary; that the bore-stroke ratio was chosen somewhat arbitrarily but is believed to be about optimum; and that the torque curve was chosen to give best overall performance.

Detroiters For

Tubeless tires were the subject of the Sept. 6 panel meeting at the Greenbrier. Panel members were, left to right: N. L. Blume of Ford; W. F. Billingsley of B. F. Goodrich; Panel Chairman Von D. Polhemus of General Motors; W. E. Lyon of Firestone; and W. H. Wallace of U. S. Rubber

The prospect for cooler driving was discussed on Oct. 5. Holding forth at the head table are, left to right, panel members W. E. Webb of Bishop and Babcock; J. R. Holmes of GMC Harrison Radiator Division; A. A. Kucher of Ford, who organized and presided over the session; P. J. Kent of Chrysler Corp.; W. E. Lind of A. R. A. Mfg. Co.; and Dr. L. A. Philipp of Nash-Kelvinator Corp.

One of the many golf foursomes that enjoyed the indian summer week-end was composed of P. H. Pretz of Ford, R. J. Williams, Jr., and F. C. Mathaei, Jr., of American Metal Products, and N. L. Blume of Ford



Pausing at the eleventh tee are W. E. Lyon of Firestone Tire and Rubber Co., M. A. Thorne of General Motors Corp., C. C. Dybvig of Firestone, and SAE guest Gold

Journey to White Sulphur Springs

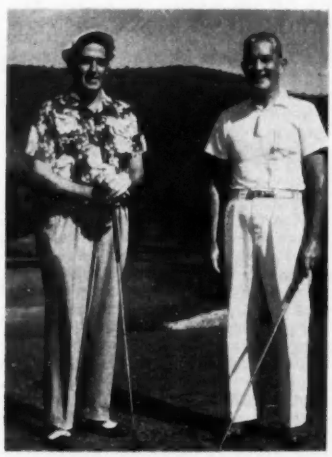
Sessions on Car Cooling, Tubeless Tires

• Detroit Section
Errol J. Gay

Sept. 5-7—Comfort and safety on the highway were the twin themes of the three-day meeting of Detroit Section at White Sulphur Springs, W. Va. Panel sessions on car cooling and tubeless tires highlighted the serious side of a weekend that also included the diligent pursuit of golf balls and bridge and canasta prizes.

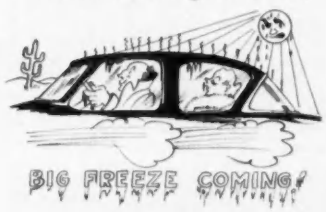
A special train brought members and guests from Detroit, Monroe and Toledo to the three-day meeting at the Greenbrier in White Sulphur Springs. T. W. Flood headed the committee that planned the meeting, and Mrs. E. M. Tasker and Mrs. J. R. Splitstone handled arrangements for ladies' golf and for bridge and canasta sessions.

The Virginia Room of the Greenbrier was the scene of Friday's technical meeting on "Air Conditioning of Automobiles." "The Tubeless Tire" was discussed in the President's Room the next day.



R. A. Stranahan, Jr., of Champion Spark Plug Co. and V. C. Young of Eaton Mfg. Co. cast long shadows on the Greenbrier's clipped green

Air Conditioning for Cars



"Today, car cooling has assumed the same relative position of demand and acceptance that car radio and car heating assumed in the early thirties. This rapidly-increasing demand for car cooling imposes upon us the fact that many things must be done in order to provide a satisfactory solution to the numerous problems involved," said Andrew A. Kucher in opening the Sept. 5 panel meeting on car cooling.

Kucher, who is director of the scientific laboratory of Ford Motor Co.'s engineering staff, organized and presided over the session. Panel members were J. R. Holmes, chief engineer of GMC's Harrison Radiator Division; P. J. Kent, chief engineer of the electrical division of Chrysler Corp.; W. E. Webb of Bishop and Babcock; Dr. L. A. Philipp, chief engineer of Nash-Kelvinator Corp.; and W. E. Lind, general manager of A.R.A. Mfg. Co. Representatives of Philco, Vickers, Inc., Carrier Corp., Fedders-Quigan Corp., Frigidaire and Tecumseh Products Co. were among the audience.

Discussion of the panel and subsequent participation from the audience indicated a growing demand for car cooling. The Bishop and Babcock Co. was among the first involved in a large scale effort to provide cooling, and in the years from 1936 to 1942 installed around 3000 mechanical cooling systems on Packard and other cars. The A.R.A. Co. of Fort Worth, Texas, has been largely responsible for renewed interest in cooling; since 1949, they have installed several thousand mechanical systems in cars of all makes. Some owners, the company reports, have had a system changed from one car to another as many as three times.

Both General Motors and Chrysler have made announcements in regard to cooling systems, and it seems apparent that other automobile manufacturers are pursuing active development programs.

For the present, systems will probably consist of a compressor in the engine compartment, driven by a belt from the engine. The condenser will be in the front of the engine radiator. The evaporator and circulating fans will be on the trunk shelf, with cooling ducts entering the body behind the rear seats.

Most engineers agreed that the best system must provide a percentage of fresh make-up air. This requires cooling capacities (rated in tons per 24 hours) in the order of 1 to 2 tons at 25 mph.

Principal Problems

Problems of vibration, noise and control are sizeable. One of the major drawbacks is the extra cooling load imposed on the radiator by the heat output of the condenser; special radiators or fans would help, but this means special vehicle models. However, these problems have been solved sufficiently well to permit the building of satisfactory and dependable systems.

There is, of course, some loss in fuel economy. But when drivers are willing to pay for installation of cooling sys-

tems, they seldom object to fuel losses.

The ideal car cooling system of the future, it was generally agreed, will be a "package" unit—a self-contained winter-summer unit. Growing public interest in car cooling, and the need to get costs down to expand the market, will provide incentive for the development of such units.

Car cooling systems are now in use in several areas of the United States, and the success of present suppliers has shown a rapidly increasing public demand. There are many problems to be met before prices will be reduced and full dependability assured, but indications are that this can and will be accomplished.

Tubeless Tires

"To the chassis and suspension engineer, the future progress of the tire industry is of paramount necessity, because within the few inches of space beneath the steel wheel rim is our only medium of contact with the road. Within that space the tire must steer the car, transmit power and absorb the millions of jolts of high speed travel."

Von D. Polhemus of General Motors thus opened the panel session on tubeless tires which he organized and moderated. Panel members were W. F. Billingsley of B. F. Goodrich Co.; N. L. Blume of Ford; W. E. Lyon of Firestone Tire and Rubber Co.; and W. H. Wallace of the U. S. Rubber Co.

Development of butyl rubber and of a means of sealing it firmly to the inner surface of the casing have made the tubeless tire possible. Tires are mounted on conventional rims, which must be in good condition and in service, and must not be pitted from rust and corrosion. Air is admitted through a standard air valve sealed into the rim. The pressure of the air in the casing holds it against the rim with sufficient force to seal against air leaks.

Cost Compares Well

Once the tubeless tire is in quantity production, it is expected that the cost will be no more, or may even be slightly less, than the cost of an equivalent quality conventional tire and a good quality tube. An intensive development program on tubeless tires is under way in the tire industry. One company has been selling tubeless tires through their stores and dealers since January, 1948; another company now has a tubeless tire for either new cars or service installations on the market. The only tubeless tires sold to date have been premium tires.

Cooler Running

Discussion brought out that the tubeless tire gives a potential cooler running capacity, possibly increased protection against blowouts, and less chance of high-speed failures and tread separation. It offers more resistance to bruising, and to the pinching of the tube that results when the tire strikes a curb or similar sharp object. The butyl interliner of the original equipment type non-puncture sealing tubeless tire clings to puncturing objects such as nails, and seals against any rapid leak until the object is removed and the hole repaired.

The tire has increased ease of balancing and tends to hold its balance better than the combination of tire and tube. Car handling is not adversely affected, and may be improved. In larger-sized tires there is less harshness and tire thump, though this feature has not been as favorable in smaller tires. There also appears to be a reduction in power loss, which is in line with the cooler-running tire.

Several problems still await solution. A system of production testing of new tires must be developed, as well as more precise manufacturing methods. A method of obtaining a satisfactory seal between the tire carcass and the butyl inner lining in production quantities must be found. Any leakage through this lining will cause casing failures.

Education in Tubeless Techniques

The problem of shipping and handling of tires for the car manufacturer must be dealt with, and the problem of mounting the tire on the wheel solved. Tire dealers, service stations and garages must be taught the techniques of repair and handling the new tires—and drivers must be taught what to do, and not do, with their tubeless tires.

The panel and the audience, who participated in an active discussion period, agreed that in general the tubeless tire offers a potential increase in safety to the driving public, and that otherwise performance is equal to or, in some respects, better than that of the conventional tire. There are manufacturing and servicing problems to be solved, but it is expected that the industry will be able to deal with these and that, possibly within the next few years, some car manufacturer will offer a tubeless tire as optional or standard equipment.

Canadians Enjoy Golf, Movies, Dinner

• Canadian Section

F. G. King, Field Editor

Sept. 26—The opening meeting of the 1952–53 season for the Canadian Section was held at the Hamilton Golf and Country Club, Ancaster. Over 90 members and their guests played golf during the day over the beautiful course, and International Harvester Co. of Canada, Ltd., was the host to over 150 members who attended the dinner. The meeting was in charge of Vice-Chairman Arthur Scarlett and Regional Vice-Chairman Douglas Park.

There was no speaker at this opening meeting, but a very interesting film was given its first public showing. Produced in color for the Steel Co. of Canada, Ltd. and titled "Steel for Canadians," the film describes, in considerable detail, but in the layman's language, the inner workings of the company's huge Hamilton plant. Blast furnaces and fiery molten metal provide interesting and highly colored footage as each step of the processing is explained.

Company officials explain that it will be distributed primarily to college, high schools and technical institutions throughout Canada.

Says Russian Aircraft Compare Well with U. S.

• Buffalo Section

Sept. 16—The Russians have some of the best in aircraft equipment, said **Frank Erny**, branch head of mechanical engineering at Cornell Aeronautical Laboratory. "They are no more copyists than we are." But when they do copy, he added, "they copy the best ideas in American and British aircraft."

Reviewing findings in experiments on a Soviet YAK-9P fighter and an IL-10 ground-support aircraft at the Laboratory, he said that the Russians move an original experimental design to the production design in from 1½ to 3 years, compared to the 3 to 5 years it usually takes in this country. Whereas in the United States there is usually "a complete redesign of the airplane to the production methods," Erny said that in Russia "they go from the experimental stage, where the airplane is almost hand-built, to production without toolin,' up in the American sense."

"In general," Erny told the group, "the Soviet airplanes are constructed good enough to do their particular job, but only good enough to do this job. This does not mean necessarily

that the airplane is going to fall apart, but rather that common sense, which is lacking in this country in a good many instances, is used in the design and manufacture."

The Russians usually build an aircraft to do a specific job and abstain from loading it down with unnecessary equipment. The U. S., he said, equips a plane to handle several jobs, sometimes overlooking "the fact that it does none of these too well." But this, he added, "is highly debatable."

Clifford J. Lane presided over the meeting, and John A. Mattison introduced the speaker.

Barnard Traces Results of Research

• Twin City Section

Donald D. Hornbeck, Field Editor

Sept. 12—A near-record number of 75 persons attended the first 1952–53 meeting of the Twin City Section to hear the Society's president, **Dr. D. P. Barnard,** address the Minneapolis group on "Research—A Partner in Engineering."

Dr. Barnard traced the evolution of the petroleum products from geological exploration, through the various refining operations, and finally into vehicle-user results. He indicated that the progress of the past half-century has been due, in large part, to the efforts of continually-expanded research staffs.

A shortage of technically trained personnel now exists, and until 1960 two to three times as many engineers will be needed as are now available.

New "Uni-Tractor" A Quick Change Artist

• Twin City Section

D. D. Hornbeck, Field Editor

Oct. 8—"A revolutionary farm machine, the Uni-Tractor provides a more or less universal, self-propelled basic carrier on which various machine bodies can be interchangeably mounted with a minimum of time expended in making the change," Martin Ronning, Minneapolis-Moline Co. chief engineer, asserted at a meeting held in M-M's new Northern Division sales' building.

A variety of power-operated machines can be had at a considerable saving in cost to the farmer since there is no duplication of power plants, supporting wheels and heavy frames, as there is with self-propelled integral machines or tractor-drawn units, Ronning continued. These attachments can include an automatic haybaler, side delivery rake, mower, and windrower, as well as the harvester, husker, and picker-sheller units.

Easily handled by lifting from the balance point, the Uni-Harvestor can be removed from the Uni-Tractor and replaced with other units, such as the Uni-Huskor, in the short interval of about 30 minutes, according to Ronning. Special units, known as the Uni-Hoist and the Uni-Transport Carriage, are provided for rapid changes and convenient transporting of units when not in use.

The power plant on the Uni-Tractor, a 60 deg V-4 using a shaft having three crank pins with a firing order of 120-180-240-180, is reported to have been designed and placed in production within a 10-day period. Developing 38 hp at 1500 rpm with a piston displacement of 206 inches, this engine provides traction power from one end of the crankshaft and belt power from the other.

While it is difficult to make an exact comparison of the economics of this equipment to either tractor and drawn equipment or self-propelled machines, it seems likely that this machine may well revolutionize harvesting equipment.

A group of 125 members and guests attended the meeting. The many colored slides shown by Ronning presented various views of the Uni-Tractor both with and without the additive harvester, husker, and picker-sheller attachments.

Open Throttle Removes C-C Deposits

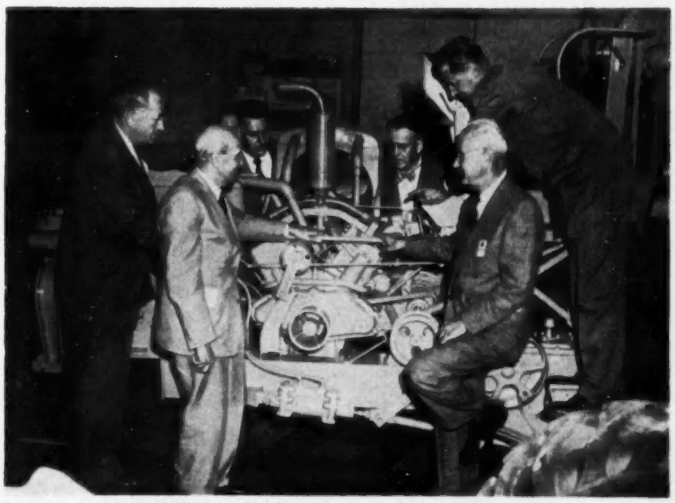
• Northwest Section

Donald F. Pennell, Field Editor

Oct. 3—"We will cover testing procedures, the effect of combustion chamber deposits on engine performance, and how deposits produce this effect." With these words **J. Brent Malin** of the Petroleum Chemicals Division of E. I. duPont de Nemours and Co. introduced his paper "Combustion Chamber Deposits."

The convoy system is used in road tests for trucks and passenger cars. To insure uniform results, drivers and positions are rotated. Road test results are correlated with laboratory experiments, which are preferred because they produce results faster. The test consists basically of running clean engines various numbers of hours and then measuring the weight and volume of the deposits found in their combustion chambers. X-ray analyses show volatile deposits occur in the cooler portions of the combustion chamber with progressively dense or non-volatile deposits in the higher temperature areas.

Knocking harm caused by these deposits are evaluated as follows: (1) Volume—20–40%. (2) Catalysis—Little or no harm. (3) Thermal insulation effect is a major contributor. The thermal insulation plus the volume amount to 66 to 75%, which leaves



Examining a Minneapolis-Moline "Uni-Tractor" at the Oct. 8 meeting of Twin City Section, which was described to the group by Chief Engineer Martin Ronning, are (left to right): A. S. Nash of Minneapolis-Moline; Section Chairman B. J. Robertson; D. J. Breining, Section secretary; Norman Ness, Minneapolis-Moline engineer; Martin Ronning; and W. E. Swenson, Section meetings chairman

a small amount of harm yet to be accounted for.

Discussion brought forth the following facts:

1. Lean fuel mixtures produce low-volume high-density deposits.
2. Thermal shock is the best known method of removing deposits (open throttle operation).
3. Deposits on spark plug electrodes vary as to electrical conductivity and are best controlled by using plugs of the proper heat range for any specific type of operation.

The Northwest Section was honored with the presence of four very distinguished guests: Tom Huxley, director of sales for the Diamond T Motor Car Co. and a 25-year member of the SAE Chicago Section; Bob Wallace, executive engineer of the Diamond T Motor Car Co. and chairman of the Chicago Section; Richard Kerr of the Arabian American Oil Co. and member of the Metropolitan Section; and Thomas C. Poulter, associate director of the Stanford Research Institute.

Describes Bendix Power Brake System

• Indiana Section

V. H. Lewis, Field Editor

Sept. 11— Modern power braking utilizing "combined" unit design shows considerable improvement over the early systems, **W. R. Williams,** executive engineer, Bendix Products Division, Bendix Aviation Corp., told Indiana Section. (See SAE Journal, September, 1952, p. 74.)

The "combined" design of power braking employs the principle of combining the power assist directly and hydraulically with the master cylinder-wheel cylinder hydraulic circuit, to achieve the advantages of pedal position control, better sealed systems, serviceability, and improved installation adaptability. It covers both air and vacuum operation. In describing the performance of the "Treadle-Vac" system—a vacuum operated power brake for passenger car use—Williams used the term "decelerator" in place of the conventional "brake pedal" which, he indicated, may be the beginning of a new era in passenger car braking.

During the interesting discussion period that followed the paper, it was brought forth that the effects of wide vacuum fluctuations can be minimized by providing an ample ratio of vacuum cylinder area to master cylinder area. The fact that lining wear and need for shoe adjustments was still apparent in the brake pedal was of interest to the maintenance group of fleet operators.

Report on Progress Of Truck Testing Project

• Northwest Section

D. F. Pennell, Field Editor

Sept. 5—An informative paper on the "Riding Characteristics of Dual-Axle Trucks," presented jointly by **Wesley Roper,** chief engineer of Page and Page Co., and **Harry Czyzewski** of Metallurgical Engineers, Inc., opened the fall program of Northwest Section.

The paper dealt with the problems involved in testing the riding characteristics of trucks, as they appear with the experiments about half complete.

One initial major problem was designing instruments for recording accelerations and forces on truck chassis caused by varying degrees of road roughness. An economical way of providing a standardized test track was found in anchoring various sizes of wooden bumper blocks to a smooth concrete apron.

Section Chairman Alfred Nelsen presided over the meeting, substituting for Vice-Chairman R. C. Norrie, who was absent on a trip to Saudi Arabia.

Tells of Advances In Helicopter Design

• Williamsport Group

Paul Cervinsky, Field Editor

Oct. 7—To make the helicopter lighter, more serviceable and dependable, constant research and energy must be expended on paper and theory work, severe bench testing of components, rigid tie-down endurance runs and expert analysis of service reports, said **Miller A. Wachs,** chief development engineer of Sikorsky Aircraft Division of United Aircraft Corp.

Wachs pointed out that this stumbling, awkward, shaking contraption has progressed very rapidly since it cast its first shadow on the transportation field twenty years ago. From a craft of unpredictable direction, it has come to play an important part daily in the rescue of downed airmen, transporting executive officers, evacuating the wounded, deliveries to inaccessible places, laying wire and pipe, and solving innumerable problems of transportation.

The enormous task of making this possible is due mainly to the tremendous amount of time spent in making the components better and better each day. In the last 10 years, Wachs says, we have been able to reduce the weight of the mechanical drive from the end of the crankshaft to the tips of the rotor blades from 3.8 lb per horsepower to 1.9 lb per horsepower. This, together with the improvements in structural efficiency, has resulted in a substantial increase in payload per hp from 2.9 to 4.2 lb. The problems of each of the separate components of the helicopter were detailed by Wachs.

The discussion period brought out that:

1. A 360 hour service period is common between overhaul.
2. No propeller icing problems are encountered.
3. Size is no problem of the single rotor blade.
4. All aluminum blades are used in place of the earlier fabric covered blades.
5. Sikorsky helicopters hold the official speed record of 129 mph and the official altitude record of 21,000 feet.

The meeting was concluded with the showing of three films dealing with helicopters.

How to Earn Employee Loyalty

• Kansas City Section

Samuel Melo, Field Editor

Oct. 7th—"You cannot buy your worker's loyalty—you have to earn it" —this was the theme and conclusion of **Ben Mills'** talk at Kansas City Section. Mills is assistant manager of the Ford Motor Co. aircraft plant at Claycomo, Mo.

The statement that we cannot expect a human being to take his place in a production line and perform like a machine is so obvious that it hardly needs to be repeated. And yet, technological developments and improved manufacturing efficiency have sometimes placed the factory employee in almost exactly that status.

Today modern industrial management realizes that failure to take the human element into account was a mistake, for it overlooks one of the key factors for increased productivity—the human will to work. In order to assure this, employees have to be treated as human beings, which means full recognition of their emotions, hopes, fears and aspirations.

So when we talk about manpower to do a job, it might be wise to substitute the word Hu-manpower; this word describes exactly what we are dealing with.

How can you earn each employee's desire to do the very best he can in whatever job he is assigned?—In theory, at least, it is simple. It is a matter of leadership. Leadership from the top down, from manager to super-

visor, from supervisor to worker. The success of this means, in the aggregate, the company's success in whatever undertaking is involved.

The actual accomplishment of this objective does, of course, present some real problems. At Ford, one answer to the problem is a continuous flow of information from management to each employee, to keep him informed of the company's objectives and policies. Management newsletters are sent out regularly to all supervisory personnel, with the understanding that they will pass on the information to those under their supervision. When matters warrant it, Henry Ford II writes to each employee at his home.

But the problem is not simply a matter of telling. It is a two-way proposition, in which it is also important to listen, for employees can bring intelligence and initiative to problems. These attempts are paying off at Ford, and surveys indicate that most of their personnel seem to feel that the responsibility of production belongs to each of them.

Mills concluded by quoting a recent Time article: "You can buy a man's time . . . but you cannot buy the devotion of hearts, minds and souls. You have to earn them."

Engineers' Contributions Not Sufficiently Recognized

• Kansas City Section

Samuel Melo, Field Editor

Sept. 16—"Our standard of living is the result of the creative genius and purposeful dedication of American engineers," stated **Ralph Teetor**, president of the Perfect Circle Corp.

By concentrating in research to discover new things, and by their continuous efforts to improve the existing things, engineers have steadily raised our standard of living, and have increased our national wealth. Automotive engineers have perhaps had the largest share in this creative process, since they have put more horsepower at the service of the American citizen than any other branch of the engineering profession, Teetor asserted.

However, engineers have been too modest in their performance and have permitted certain party politics to claim credit for developments they have not caused and about which they know nothing. Some politicians are now bent on siphoning an ever-increasing portion of the wealth created by engineers into non-productive or even destructive projects, such as wars and ill-conceived foreign ventures, which very definitely threaten to lower and have already begun to lower our standard of living. It is the responsibility

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of American engineers, who know the facts, to make the public aware of how much effort, care and research has been needed to make our civilization, Teetor said. It is also our responsibility to make sure that it is not destroyed or damaged beyond repair by irresponsible or ignorant governments.

The youth of America, and very specially the children, should be taught with a new educational philosophy that will enable them to understand how difficult it is to create anything and how much dedication, know-how and endurance it takes to produce something new or to improve something old.

Only by a correct understanding of these values, and by continued creative effort, can we save our civilization and preserve peace in the world. Engineers should be very conscious of this, and should spread this consciousness among the rest of the American people, Teetor concluded. Only in this manner, and not by political talk and hot air, can we assure the future of America and the happiness of our children and our children's children.

Barnard Speaks At Colorado Group

• Colorado Group

Robert F. Brown, Field Editor

Sept. 24—At a dinner meeting at Denver's Petroleum Club, Colorado Group members heard SAE President **D. P. Barnard** speak on "Research—A Partner in Engineering." Dr. Barnard traced the development of research activities and effectively pointed out that research has become an integral part of successful engineering.

Preceding Dr. Barnard's address, Edward Rentz, Jr., SAE west coast representative, presented a slide-illustrated talk on "The SAE Story," summing up the position and activities of the SAE in its professional field.

Dispute Optimum Of Lube Oil Filtration

• Metropolitan Section

Sept. 18—First dinner meeting of the new season took up the subject of lube oil filtration. A paper by **Jules P. Kovacs**, vice-president of Purolator Products, Inc., was supplemented by four prepared discussions.

Because of the author's illness, the paper was read by Herbert R. Otto, Jr., Purolator's chief engineer.

Discussers agreed upon the need of filtration for internal combustion engine lubricating systems, although the

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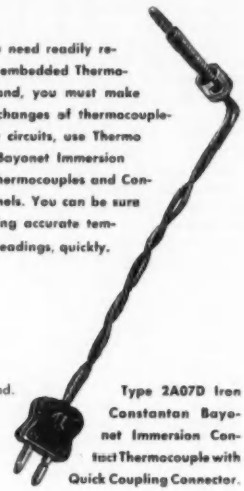

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question of the amount of material to be removed remained open.

Kovacs held that full-flow filtration is the optimum method, but pointed out that adequate intake air filtration is needed to assure adequate protection to engines.

His thesis that full-flow filters are preferable to those of partial-flow types was dramatically supported by the results of an extensive series of tests after which measure of wear of cylinder bores, main and connecting rods, and pistons was made.

William S. James, vice-president of Fram Corp. and an SAE past-president, offered a formula for filtration. He and W. J. Pelizzoni of Mack Mfg. Co., W. A. Hunter of Chrysler Corp., and R. J. Pocock of Ford pointed out that excessive weight, size and cost of highly efficient air filters would be prohibitive in cars, trucks and buses; they agreed, however, that makers could produce such a device, in view of extensive research and development work done by them and vehicle manufacturers.

Several past-chairmen of Metropolitan Section, several of whom were accompanied by their wives, were in the audience of nearly 150 members and guests. More than 20 enrolled student members of SAE were present.

Harold A. Strohman, vice-chairman for diesel engineering, arranged the meeting and conducted the technical session.

Rockets Date From 13th Century

• Southern New England Section
A. D. Nichols, Field Editor

Oct. 7—About 140 members and guests heard **Raymond W. Young**, president and general manager of Reaction Motors, Inc., deliver a paper on "Rocket Powerplants."

Young opened his talk with a short history of rockets, which date back to the Chinese in the 13th century. Later the British used rockets in 1807, firing some 30,000 during the attack on Copenhagen, and again in the War of 1812. The liquid propellant rocket, a more recent development, was used by the Germans who built and fired about 4,000 during World War II.

Various types of fuels and oxidizers were discussed with the relative merits and disadvantages of each pertaining to manufacturing, handling and tankage facilities.

A slide showing the schematic diagram of a liquid propellant rocket was shown, and Young described the function of each unit. Cooling the thrust chamber, metallurgy of the materials in the engine, pumps for the high pressures and highly corrosive propellants are only a few of the problems involved

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in the design and manufacture of rockets.

The installation of Reaction Motors rockets in the Bell X-1 and the Douglas "Skyrocket" were shown and discussed, and several future possible uses of rocket powerplants were described.

The talk was illustrated with slides, and two films were shown. One film showed some of the German experience with rockets during World War II and the other showed flight testing of the Bell X-1 and the Douglas "Skyrocket."

Power Steering And Braking Described

• Chicago Section

D. J. Schrum

Sept. 15—The South Bend Division of Chicago Section opened the fall season with a twin-billing program on passenger car applications of power steering and power braking. About 120 members and guests heard **H. E. Hruska** of Bendix Products Division present "Power to Steer" and **E. E. Hupp** present "Power to Stop."

Power Steering

Power steering, as well as braking, for passenger cars is a natural outgrowth of power assistance on heavy commercial and military vehicles, which is necessary to control these enormous weights. Probably the most significant of these forerunners is the "central hydraulic system" designed for buses and adopted by Mack Mfg. Co. for their 1950 Model 50 passenger bus, and the White 50 passenger bus. This gear operates from a stored pressure supply and its valve is centered solely by pressure reaction, giving a light and sensitive wheel at the sacrifice of self-returnability, Hruska said.

In the development of passenger car steering, two approaches are being made, each with individual merits: the integral gear, which is adaptable where space will permit the bulky installation; and the booster form, where linkages can be designed to accept it.

The standards of refinements being used as a basis for design of passenger car power steering are:

1. Self-returnability should equal that of manual control.
2. Valve sensitivity should be high enough to prevent feeling of lost motion.
3. There should be no transition between power off and power on, resulting in oversteering.
4. "Parking" effort should be from 7 to 10 lb, with response to any reasonable rate of wheel turning.
5. The car should have "road feel."
6. The system should be stable, holding the car in a straight line with hands off the wheel.
7. Some degree of reduction in overall

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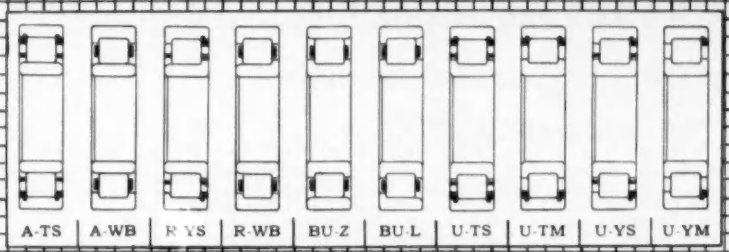

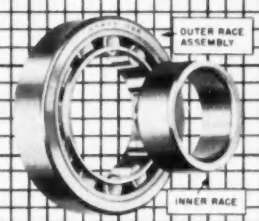

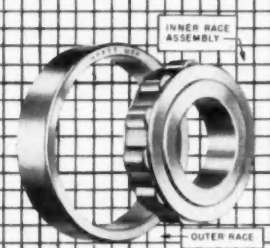

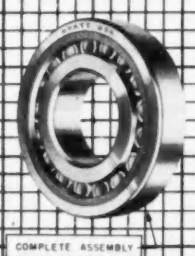

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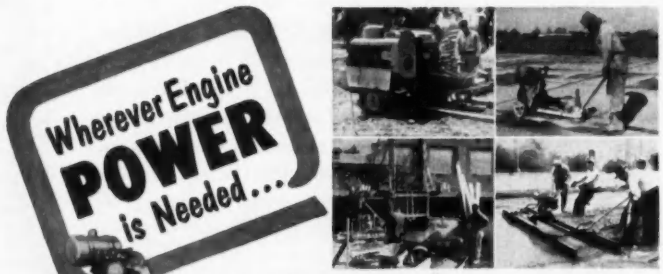

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steering ratio is desirable.

These factors incorporated in the present hydraulic systems are reducing physical exertion of driving to the point where only skill and coordination are required for perfect driving, Hruska concluded.

Power to Stop

A new concept of power braking, a refinement of previous commercial applications, has been brought about with the automatic transmission, Hupp said. Although the left foot is no longer needed in driving, the right foot is used for operation of both accelerator and brake. This latest brake system makes it possible to operate the accelerator and brake pedals without lifting the heel from the floor. Brake pedal height and travel have been reduced so that the pad is at approximately the same level as the accelerator.

This system, the "Treadle-Vac," is a combined vacuum and hydraulic unit which utilizes intake manifold vacuum and atmospheric pressure as a power source. It is a self-contained unit which requires no exposed linkage, since actuation is by direct applied force. It embodies the master cylinder within itself, which is operated by a force transmitted to it directly from the foot through the pedal. As pedal pressure is applied, vacuum is applied to the lower side of a moving piston in the system, which assists in actuating the master cylinder. In operation, one-third of the pressure required is applied by the foot and two-thirds furnished by the vacuum booster, Hupp told the group.

A diaphragm in the vacuum unit produces a reaction on the pedal which gives a true reflection of brake position and intensity of application.

Pilot's-Eye View Of Record-Breaking Flight

• Metropolitan Section

S. G. Tilden, Jr., Field Editor

Oct. 1—**Charles F. Blair, Jr.**, who received the 1952 Harmon Trophy from President Truman this month, told the Metropolitan Section "How the Harmon Trophy Flight was Achieved" at an activity meeting held in the Garden City Hotel.

Blair, described by Activity Chairman J. T. Farrah as "a pilot's pilot," gave all the details of the planning and execution of his record-breaking flight from New York to London and his subsequent solo flight from Oslo, Norway, over the North Pole to Point Barrow, Alaska. He made the flights in his own plane and largely at his own expense, while he continued to fly his regular transatlantic run as a captain for Pan-American Airways. He made the flights to advance his hobby of navigation, he said.

Blair's airplane was a P-51 which he purchased from Paul Mans, Bendix Trophy winner. Blair equipped it with a new Rolls-Royce 9 Merlin Engine with a two-speed blower, which gave him a ceiling of 40,000 feet. He added additional fuel tanks, so that he carried a total of 865 gal, divided 205 gal in each wing, 280 gal in the center section of the wing, and an additional 175 gal behind the pilot's seat. This brought the airplane gross load to 12,500 lb, considerably more than the 10,500 lb certified gross load for the airplane. Performance was extremely sluggish until the gas behind the seat was used.

Riding the Jet Stream

The record-breaking, 450 mph, New York-to-London flight was made by flying his P-51 in the "North Atlantic jet stream." The jet stream, Blair said, is the front or barrier between the polar air mass and the warmer continental air mass. In the zone where these masses mix, between 15,000 and 45,000 ft, winds of 200 mph are common; some have been measured as high as 315 mph.

By flying in this jet stream, Blair had an average 60-knot tail wind component for the whole trip, and was clocked by radar at one point over the Atlantic at 600 mph. The trip was made at 30 to 35,000 ft at 2700 rpm and 46 in. manifold pressure. Navigation was principally by ADF and by radar fixes from weather ships enroute. Upon arrival in London, he still had enough gas to use Rome as an alternate airport.

Over the North Pole

The polar crossing presented a challenge in navigation, and extremely hazardous forced landing conditions. "The best means of survival is to be sure you're up and running good before you start out," Blair said.

After months of planning his navigation for the flight, Blair picked a departure day and hour when the sun and moon were at approximately right angles for best triangulation. On the flight his principal aid was an astrocompass which he used as a simple polaris to get the relative bearing between the nose of the plane and the sun, thus its relative bearing, and setting the directional gyro from this. Every ten minutes, he turned two degrees towards the sun.

Blair took off from Oslo at 16:00 o'clock, their time, and arrived at Point Barrow at 15:35 the same day, Point Barrow time.

Of the flight across the pole, Blair said, "Any airline could fly across there as easy or easier than the transatlantic run." Navigation is more difficult, but weather over the pole is generally better, cold air performance of the airplane is better, and many times the polar route is shorter. For example, the polar route to Japan is 1500 miles nearer than the transoceanic run. In light of this, Blair predicted considerably more use of polar routes in the future.

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Technical Digests

Continued from Page 86

models will be started, using the basic sections, but varying with the taste of the individual designer in charge. At this point all engineering and cost departments which might be affected are called in to give their opinions so that controversial matters can be ironed out promptly. Then management is shown all models for its opinion.

Assuming that one model meets with full approval, work is begun on a full size clay model. A wooden clay form or buck is made. This comprises a sturdily constructed armature on which will be put 4 or 5 in. of clay and the surfaces modeled to the proper contours. When styling, engineering, cost, and production agree to support the design, it is again shown to management. The reaction may be favorable, unfavorable, or mixed. Suggested modifications may have to be worked out. But if the model is approved as is, the final step can be taken.

This last step is to translate the clay model into an easily transmittable form by taking templates of it at intervals of 5 to 10 in. and using these lines as the basis for a preliminary body draft which can be transmitted to the various departments handling the job from here on to production. (Paper, "Practical Designing," was presented at SAE Junior Panel Meeting on Passenger Car Styling—Detroit Section, March 24, 1952. It is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members; 50¢ to nonmembers).

Arch Logging Creates Complex Design Problem

Based on paper by

H. F. WAHL

Hyster Co.

ARCH, winch and tractor can be said to compose an integrated machine. The location of the arch fairlead is just as important to tractor balance as the location of the drawbar hitch. The height and overhang of the winch drum is just as important as the arch wheelbase or the tractor's center of gravity. All this tends to make manufacturers of arches and winches con-

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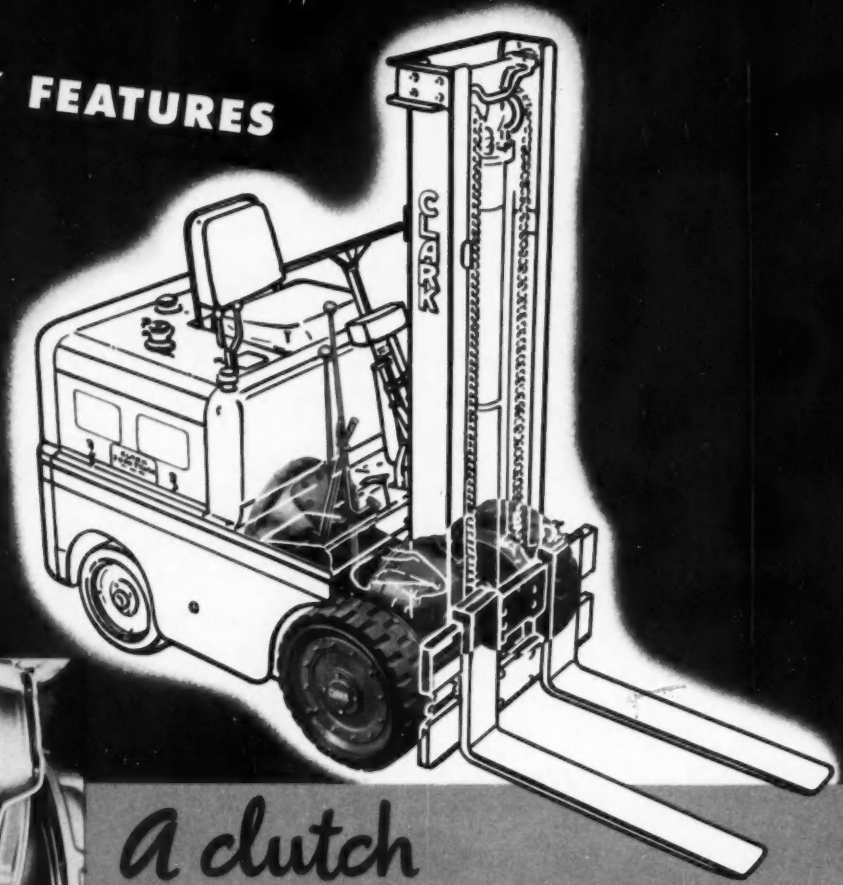

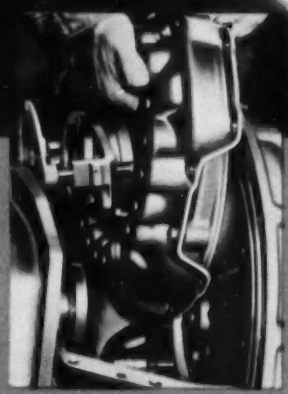

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a clutch you can change IN 80 MINUTES

THE CLUTCH is far and away the most vulnerable part of a fork-lift truck. It takes the brutal strain, torture and wear each day of hundreds of stops, starts, "inching" maneuvers, shifts from forward to reverse and vice versa. In just one week of work it takes more punishment than your automobile's clutch takes in a year.

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centrate on one particular tractor so that in effect the combination tends to be an integrated machine. Nevertheless arches are interchangeable. It is the fine points that show up in rough country where arch dimensional differences prove a difference in performance.

The modern SAE tractor pulling the old high arch up a 26.8% grade results in a tractor balance of 31,770 lb on the rear sprocket and 9630 lb on the front. With a modern arch behind the same tractor and on the same grade, using a low hitch, weight on the rear sprocket is 27,700 lb and on the front sprocket 12,700. This is a great improvement. With 4000 lb of redistributed weight the difference of total tractor weight on the ground between high and low hitch is only 1000 lb.

With a total arch load of 70,000 on a 10% grade we have a rear sprocket loading of 17,750 lb, a front loading of 3780 lb, and a maximum low gear tractive effort of 29,410 lb to climb the grade. Here we have more powerful tractors, trailing lighter equipment and hauling heavier loads. It couldn't be done 25 years ago.

Normally speaking, the dozer tractor cannot be loaded much beyond the full horsepower delivery of the engine except by impact. The rear end of the arch tractor can be overloaded, even to the point of driving the tractor over and beyond its rated top speed. Even though the tractor as a basic machine is sold in much greater volume as a dozer tractor, the real test of a good rear end, transmission and steering design rests in its behavior as a downhill arch tractor. Operators in steep downhill country have more tractor rear end maintenance than those in level country or under conditions of power application more nearly like the loading of a dozer tractor.

The foregoing does not mean that tractors should be designed specifically for arch logging. The volume doesn't warrant the expense, and more can be accomplished by training operators. As an example: one operator will break over the crest of a hill with the arch load hanging high, and drop the load on the fly to gain a little time. In the process he slides the tractor, with tracks locked, for 40 ft on a 40% plus grade before he has full control of the machine. A more conservative operator would drop the load and proceed over the crest using the load as a brake.

To illustrate the importance of dimension, take the example of a logging arch on a 40% grade with three wraps of the arch line on the winch drum instead of one wrap. This, in effect, moves the project line of the cable 2.4 in. and such an increase in the lever arm under these circumstances increases the rear sprocket reaction by 1600 lb for a total of 54,500 lb, while the weight on the front sprocket is reduced 990 lb for a total of 5950 lb. It is obvious, therefore, that when handling heavy loads a change as little as

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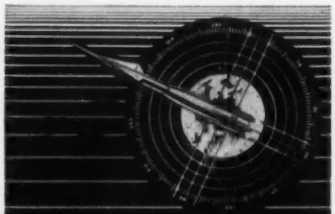

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an inch or more in lever arm measurement has a very important effect. (Paper, "Logging with Tractors—Equipment, Logging Arch and Winches," was presented at SAE National Tractor Meeting, Milwaukee, Sept. 9, 1952. It is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members; 50¢ to nonmembers).

Based on Discussion

George Carr

Pacific Car & Foundry Co.

SEVERAL variables which influence performance under dynamic conditions are: range of grade, ground conditions, and length size and weight of logs. At first glance these might not appear capable of producing a complex series of conditions, yet the effect of their influence in various combinations results in a basic arch design flexible enough to absorb these variables and provide at all times the best possible traction characteristics for the tractor prime mover.

It is certainly true that small changes in lever arm measurements have a very important effect. Also, it is observed under dynamic, or operating conditions in arch logging, that compensating adjustments must be provided to handle the normal variations encountered. Since a relatively small change in location of the lines of force accomplishes a measurable re-location of tractor balance, it is accepted practice to provide predetermined adjustments resulting in optimum operational performance. From this point it is a short step for the arch engineer to provide suitable balance adjustments to accommodate the use of these logging arches behind various makes of tractors, as equipped for logging (with or without dozers), in a given tractor class.

R. W. Beal

Engineer Research & Development Laboratories
Engineer Corps.

LIMITED tests have been conducted on a "tandem yoke" device which permits coupling two standard tractors together in tandem to accomplish more or less unified operation of them. The dozer blade and push arms of the rear tractor are replaced by the yoke which attaches to the dozer trunnions and to the same hydraulic rams which operate the blade. The yoke front end fits into a socket supported by a bracket which in turn is bolted to the standard rear face plate of the front tractor. The bracket replaces the standard drawbar and guide assembly. No modification of either tractor is necessary and the rear tractor's rear face plate is available for normal winch mounting.

Preliminary tests at ERDL have

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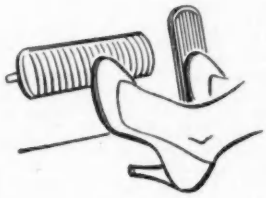
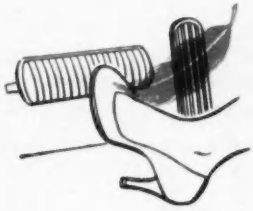


Now you can brake with either right or left foot to save your energy!

No more driving constantly with your *right* foot on a brake too far to the right.

No more hard "tramping" on a brake pedal causing foot, and leg strain!



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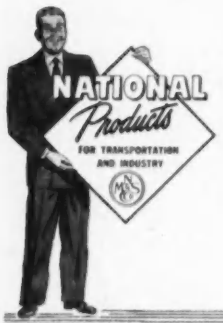

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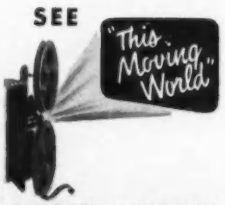

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shown that the tandem combination can negotiate adverse terrain beyond the capability of either tractor independently. Under favorable traction conditions on the level, the weight transfer feature has permitted the development of more drawbar pull by the tandem than could be developed by the two tractors operating in tandem with only a tow-chain connection.

Since this increase in drawbar pull was more than could be attributed to the weight contributed by the yoke itself, it is thought to result primarily from ability to keep uniform pressure distribution under all tracks.

How Speed Influences Farm Tractor Operation

Based on paper by

E. G. McKIBBEN

and

I. F. REED

Bureau of Plant Industry
Soils and Agricultural Engineering, USDA

SINCE a farm tractor's operating weight is determined by weight needed for traction and not by strength of construction requirements, increased speeds would make possible lighter, lower cost tractors. Higher speeds would call for more complicated design and better materials, making the cost per pound higher, but there would still be real savings. This would be true of implements as well. The width of an implement is inversely proportional to the practical operating speed and the weight per foot of width increases as the implement is widened. Thus construction materials required for a given area would be inversely proportional to the operating speed or less.

Perhaps the most important objection to increased speeds is the obstruction of stones, rocks and stumps. To counteract this, break pins, cushion springs, overload releases and clutch throw-outs have been applied to drawbars, and similar devices applied to cultivator teeth and plow bottoms. Effective application of these devices becomes more difficult with increased speeds and wider use of mounted tillage equipment. The most satisfactory solution would be remove the obstructions, and it should be possible.

Accurate steering for row crop operation is another limitation on higher speeds. If a crooked row must be followed, more consideration must be given to guiding the implements rather than depending wholly on the steering of the tractor and the entire

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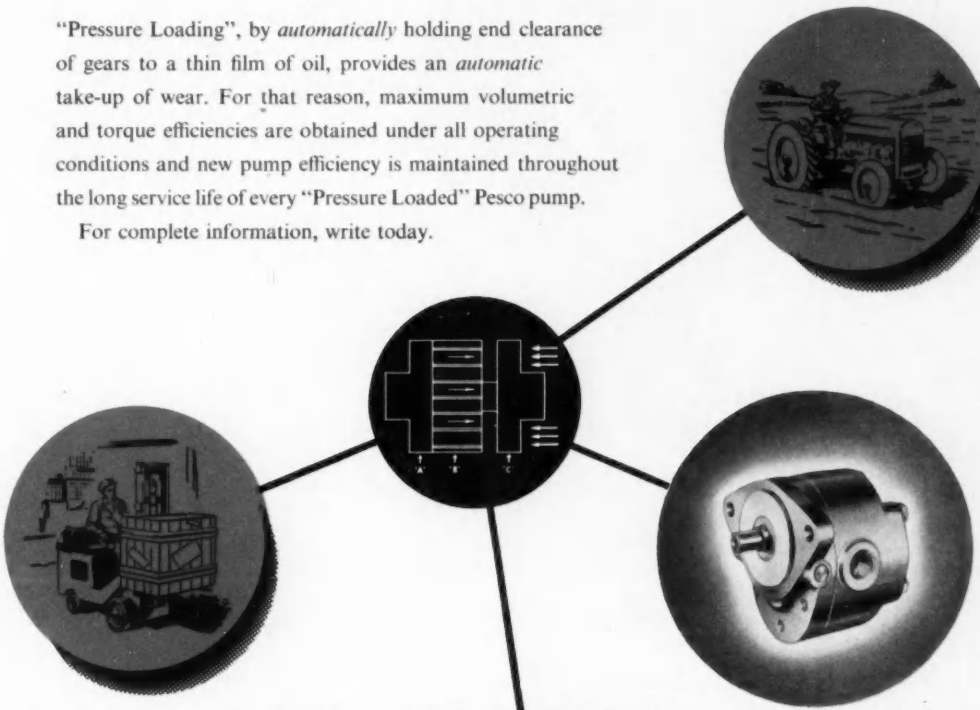

Pesco Products Division, Borg-Warner Corporation | 24700 North Miles Road, Bedford, Ohio

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A Twin Disc Model SLT Spring Loaded Clutch—designed for extra-heavy duty—provides the power link in this Le Roi 315D Airmaster compressor with wagon drill, at work in a quarry near Waukesha, Wisconsin. Engine is an International UD-18 Diesel.

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machine. It is time power steering was considered. If and when speeds are increased, operator fatigue will have to be lessened. It may be necessary to carry part of the tractor weight on springs.

Investigation has shown that the draft of tillage implements increases as speeds are increased. Test data tells us that as the speed of a primary tillage implement is increased above 3 mph, the per cent increase in draft will probably be between 5 and 15 times the 1.5 power of the increase in speed. At higher speed there is undoubtedly more breaking up of the soil, but this effect cannot be evaluated. It is true that if a designer developed a plow for satisfactory operation at 10 mph it would probably perform very poorly at 2 mph, since placement of the furrow slice is different at different speeds.

Each increment in speed will bring smaller benefits in time and material saving than the preceding equal increment did. Our present speeds are at least double the horse speeds from which tractor development started, thus we are saving at least half the time and material required at horse speed. This is a greater saving than ever can be made again. (Paper, "The Influence of Speed on the Performance Characteristics of Implements," was presented at SAE National Tractor Meeting, Milwaukee, Sept. 10, 1952. It is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members; 50¢ to nonmembers).

Based on Discussion

K. L. Magee
J. I. Case Co.

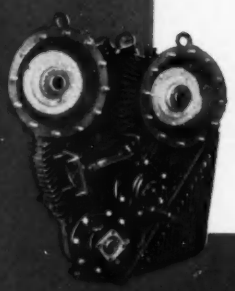
CONSIDERATION of higher operating speeds for implements does not necessarily imply that all speeds should be increased. What we do consider is the broad scope of speed whether it be slow or fast. Higher speeds for cultivating, hay mowing, and some other operations seem to be the order of the day, but the extension of power take-off operation to more and more power driven machines has put greater demands on tractors for slower ground operating speeds. Thus, it is evident how great is the diversity in operating speeds.

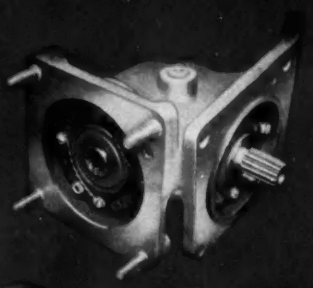
The farm machinery designer has a very great problem still ahead to find the most satisfactory operating speed for any given machine as well as for the broad application of machines as it effects good operation and performance, better design, and safer operation.

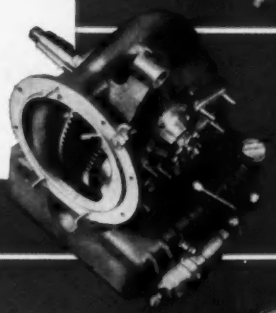
E. W. Tanquary
International Harvester Co.

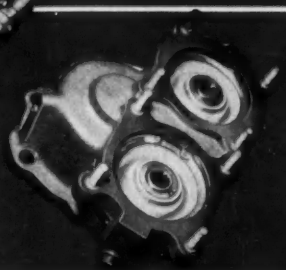
IN THE search for increased output of farm machinery, present requirements for a complete range of oper-

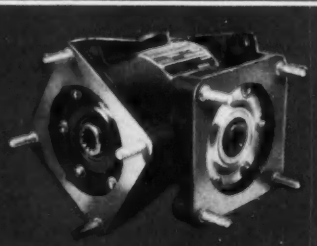
HEADQUARTERS
FOR
AIRCRAFT ACCESSORY DRIVES

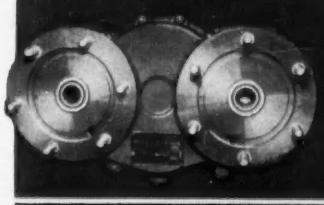


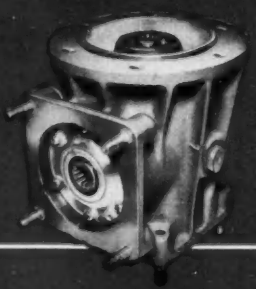












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Just a few of the many drives produced by Western Gear Works for aircraft-engine accessories are illustrated on this page.

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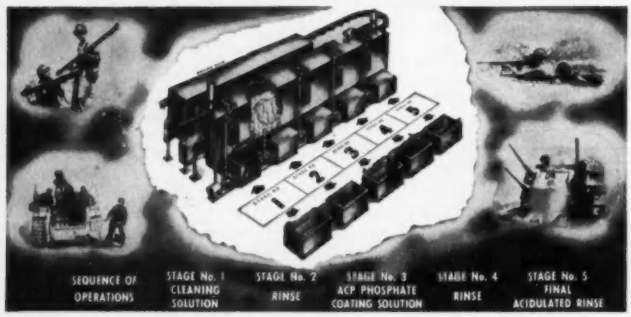
Technical Service Data Sheet
Subject: METAL PRESERVATION AND PAINT PROTECTION WITH ACP PHOSPHATE COATING CHEMICALS


SEQUENCE OF OPERATIONS
STAGE No. 1 CLEANING SOLUTION
STAGE No. 2 RINSE
STAGE No. 3 ACP PHOSPHATE COATING SOLUTION
STAGE No. 4 RINSE
STAGE No. 5 FINAL ACIDULATED RINSE

U.S. ARMY PHOTOGRAPHS COURTESY OF "ORDNANCE MAGAZINE"

Typical spray and dip phosphating equipment and some ordnance products that are now given a protective phosphate coating for extra durability under all kinds of severe exposure conditions. Both military and civilian applications of ACP phosphate coating chemicals are shown in the chart below.

SELECTION CHART OF ACP PROTECTIVE COATING CHEMICALS FOR STEEL, ZINC, AND ALUMINUM

METAL	ACP CHEMICAL	OBJECT OF COATING	TYPICAL METAL PRODUCTS TREATED	GOVERNMENT SPECIFICATIONS
STEEL	"GRANODINE" Zinc Phosphate Coating Chemical	Improved paint adhesion	Steel, iron, or zinc fabricated units or components, automobile bodies, refrigerators, washing machines, cabinets, etc.; projectiles, rockets, bombs, rifles, small arms, belt links, cartridge tanks, vehicular sheet metal, tank belts and links, recoilless guns, etc.	MIL-S-5002 JAN-C-490, Class 1 JAN-F-495 U.S.A. 57-0-2, Type II, Class C U.S.A. 51-70-1, Finish 22.02, Class C U.S.A. 50-60-1 16 E4 (Ships)
STEEL	"PERMADINE" Zinc Phosphate Coating Chemical	Rust and corrosion prevention	Nuts, bolts, screws, hardware items, tools, guns, cartridge clips, fire control instruments, metallic belt links, steel aircraft parts, certain steel projectiles and many other components.	MIL-C-16232 U.S.A. 57-0-2, Type II, Class B U.S.A. 51-70-1, Finish 22.02, Class B Navy Aeronautical M-364 U.S.A. 72-53 (See An-F-20)
STEEL	"THERMOIL-GRANODINE" Manganese-Iron Phosphate Coating	Wear-resistance anti-galling, safe break-in of friction or rubbing parts. Rust proofing.	Friction surfaces such as pistons, piston rings, gears, cylinder liners, camshafts, tappets, crankshafts, rocker arms, etc. Small arms, weapon components. Hardware items, etc.	MIL-C-16232 U.S.A. 57-0-2, Type II, Class A U.S.A. 51-70-1, Finish 22.02 Class A Navy Aeronautical M-364 U.S.A. 72-53 (See AN-F-20)
STEEL	"GRANIDAM" Zinc-Iron Phosphate Coating	Improved drawing, extrusion, and cold forming	Blanks and shells for cold forming, heavy stampings; tube; tubing for forming or drawing; wire; rod; etc.	———
ALUMINUM	"ALODINE" Protective Coating	Improved paint adhesion and corrosion resistance	Aluminum products of similar design such as refrigerator parts, wall tile, signs, washing machine tubs, etc; aircraft and aircraft parts; bazookas (rocket launchers), helmets, belt buckles, clothes dryers, clothesline, rocket motors, etc., aluminum strip or sheet stock.	MIL-C-5541 (See also QPL-5541-1) MIL-S-5002 AN-F-20 U.S. Navord O.S. 675 16 E4 (Ships) AN-C-170 (See MIL-C-5541) U.S.A. 72-53 (See AN-F-20)
ZINC	"LITHOFORM" Zinc Phosphate Coating Chemical	Improved paint adhesion	Zinc alloy die castings; zinc or cadmium plated sheet or components; hot dip galvanized stock; galvanneal; signs; siding; roofing; galvanized truck bodies; etc.	QQ-P-416 RR-C-82 JAN-F-495 AN-F-20 U.S.N. Appendix 6 U.S.A. 72-53 (See AN-F-20)

CHEMICALS ACP PROCESSES

WRITE FOR DESCRIPTIVE FOLDERS ON THE ABOVE CHEMICALS AND FOR INFORMATION ON YOUR OWN METAL PROTECTION PROBLEMS

CHEMICALS ACP PROCESSES

ating speeds should not be overlooked. The problems of transplanting, planting and cultivating of vegetables, power take-off balers, forage harvesters, and so forth are still with us.

Perhaps the implement engineers will be able to accept higher speeds. Certainly that is the objective. However, for the present, a wide range of operating speeds is required to prepare and plant soil, then cultivate and harvest the crops grown.

In the search for speed, safety aspects must not be sacrificed. Sharp turns at high present a definite hazard. This is particularly true when rear wheels are set in a narrow tread position.

New Alloys a Boon To Aircraft Designers

Based on paper by

GORDON A. FAIRBAIRN

North American Aviation, Inc.

THREE relatively new precipitation hardening type stainless steels give the aircraft designer materials with inherent corrosion resistance adequate for aircraft application combined with mechanical strengths comparable to those of highly heat-treated low alloy steels. Use of these new alloys has led to substantial savings in man hours and tooling costs.

One of these alloys, known as 17-4PH, is essentially a heat-treatable iron base bar and forging alloy containing 16.5% chromium, 3.5% nickel, 3.5% copper, and 0.35% columbium plus tantalum. Salt spray tests show that in a heat-treated state its corrosion resistance is comparable to 18–8 type stainless steels.

Without heat-treatment, 17-4PH has a Brinell hardness of 286–337. It can be heat-treated to 180,000–210,000 psi by precipitation hardening at 850–900 F for one hour followed by air cooling. Distortion is not a problem because of the relatively low temperature required and the absence of a drastic quenching operation. It is usually possible to finish machine parts prior to heat-treatment. The dimensional change during hardening is very slight, being a contraction in the order of 0.0005 in. per in. of length. Heat-treatment produces a discoloration which can be removed by immersion in nitric-hydrofluoric or by a light sandblasting.

Machinability in the nonheat-treated state is relatively good for a stainless steel alloy and comparable to SAE

How the casting of a camshaft saved industry $42,000,000!

Only a few engine builders realized back in 1932 that Campbell, Wyant and Cannon really had something in the *cast* camshaft. Since that time, many others found that CWC's casting process could make important cost reductions and together they saved over $42,000,000. Together they bought from CWC 33,000,000 *cast* camshafts!

CWC *cast* camshafts are *produced* at a lower cost! Made of electric furnace alloyed metal, they require *less* machining and *easier* machining. They permit unrestricted engine design—positive control of Brinnell specifications—eliminate heat treating—and resist corrosion and wear. Regardless of the number of engines you make—the same proportionate savings can be yours with CWC *cast* camshafts!

CAMPBELL, WYANT AND CANNON
FOUNDRY COMPANY
Muskegon, Michigan

CWC
Since 1908

METALLURGICAL ENGINEERING provides unlimited possibilities in product design

PRECISION CONTROL assures the desired casting

MECHANIZATION to produce castings at reasonable cost

Small orders...
Large orders...
you can depend on the...
top 10 SOURCES for Mechanical Springs
Divisions of Associated Spring Corporation and Canadian Affiliate
WALLACE BARNES COMPANY
Bristol, Connecticut
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BARNES-GIBSON-RAYMOND
40300 Plymouth Rd.
Plymouth, Mich.
B·G·R COOK PLANT
Ann Arbor, Michigan
F. N. MANROSS AND SONS CO.
Bristol, Connecticut
OHIO DIV.
Associated Spring Corporation
1712 East First Street
Dayton, Ohio
DUNBAR BROS. COMPANY
Bristol, Connecticut
MILWAUKEE DIV.
Associated Spring Corporation
341 East Erie Street
Milwaukee, Wisconsin
THE WALLACE BARNES COMPANY LTD.
Hamilton, Ont., Canada

4130 steel which has been heat-treated to 140,000 psi. It is possible to specify a 5–10 micro-finish on machined surfaces.

The second of these alloys, 17-7PH, is essentially a heat-treatable iron base sheet and wire alloy containing 17% chromium, 7% nickel and 1% aluminum. We have largely replaced ½ hard 302 sheet with this alloy, particularly where considerable forming is required, because the former imposed limitations on designs from the standpoint of strength and formability.

In comparison with the ½ hard sheet which has a design allowable tensile ultimate strength of 150,000 psi and an allowable tensile yield strength of 110,000 psi, 17-7PH sheet has an allowable tensile ultimate strength of 180,000 psi, and an allowable tensile yield strength of 150,000 psi in the heat-treated condition. It also provides a compressive yield strength of 150,000 psi irrespective of grain direction as compared with the 80,000 psi (transverse) and 110,000 psi (longitudinal) values which must be used with the ½ hard 302.

The heat-treatment we follow is a transformation treatment for 30 min at 1400 F followed by cooling to 60 F, then an aging treatment at 1050 F for one hour followed by air cooling to room temperature. In cooling from 1400 to 60 F the alloy transforms from austenite to "soft" martensite in which condition it can be hardened by subsequent aging treatment. Warpage is normally not a problem, except with large parts. It occurs mainly during the 1400 F treatment with little change taking place during aging. It does not harden appreciably during this treatment and warped parts can be reworked easily prior to age hardening. During the transformation treatment there is a growth of approximately 0.004 in. per in. of length. Aging produces a shrink of approximately 0.0003 in. per in. of length. A tight black scale is produced during the heat-treatment which we remove by sandblasting followed by passivating in nitric acid solution. The surface is satisfactory for resistance welding. Spotwelding and seamwelding are being performed successfully, using machine settings comparable to those used for the ½ hard sheet.

In the form of wire, 17-7PH affords a corrosion resistant material which can be heat-treated to a tensile strength comparable to music wire. To obtain maximum strength the wire is procured in the cold worked condition (approximately 60% reduction) and fabricated into parts which are then hardened by aging at 850 F for four hours. This also serves the purpose of relieving the forming stresses.

Stainless "W", the third of these alloys, has a heat-treatable iron base containing 17% chromium, 7% nickel and about 1% aluminum plus titanium. It is heat-treated from the annealed condition to a tensile strength of 180,000 to 220,000 psi by precipitation hardening for one hour at 950 F. In comparison with 17-7PH it was found to warp less during heat-treating, but was less ductile in the annealed condition. This low ductility made necessary limiting its use to those production parts which required only a limited elongation in the forming operation. A comparison showed that five times as many acceptable production parts could be made with stainless "W" as could be made with the ½ hard sheet, expending the same number of man hours. (Paper, "Precipitation Hardening Steels Show Advantages in Aircraft," was presented at SAE National Aeronautic Meeting, Los Angeles, Oct. 3, 1952. It is available in full in multilithographed form from SAE Special Publications Department. Price: 25¢ to members; 50¢ to nonmembers).

If You're Up-In-The Air
ABOUT YOUR FUTURE

REMEMBER

PIASECKI

(Pronounced PIE-SEK-EE)

THE PIONEER BUILDER OF TRANSPORT HELICOPTERS

—is one of the most rapidly expanding companies in its field, with a present need for its products in our nation's defense effort PLUS an untapped post-war commercial market that assures BOTH recognition and good pay to—

ENGINEERING DESIGNERS & DRAFTSMEN

—with aircraft experience on Airframes, Controls, Electrical and Power Plant Installation.

If you want to get the facts about a down-to-earth employment opportunity where you can keep your feet on the ground, tell us in detail about your qualifications for these openings. Write

MR. W. J. HATCHER
Employment Manager

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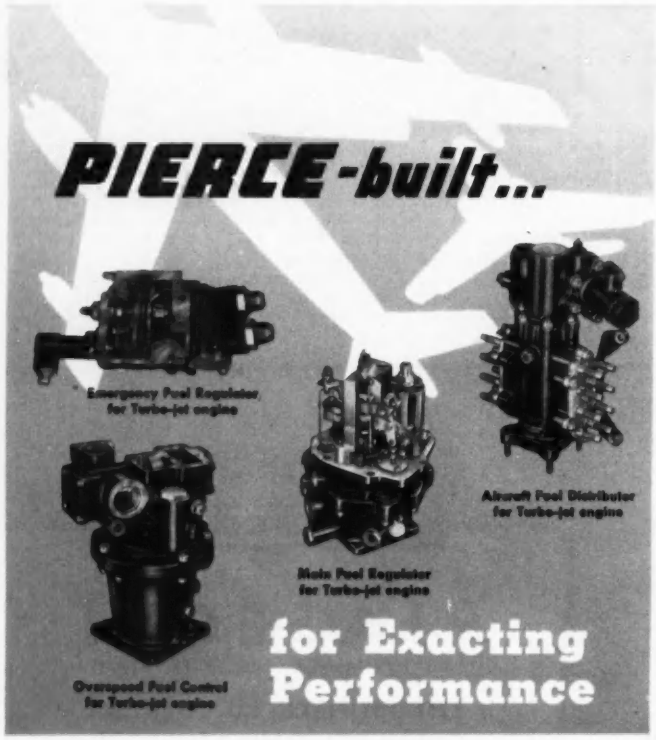
A Philadelphia Suburb NEAR SWARTHMORE


PIERCE-built...
Emergency Fuel Regulator for Turbo-jet engine
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Main Fuel Regulator for Turbo-jet engine
Overspeed Fuel Control for Turbo-jet engine
for Exacting Performance

Pierce experience and production facilities are available to YOU

Precision fuel control equipment, shown above, are vital mechanisms . . . built by Pierce to equip America's finest turbo-jet aircraft engines. Tolerances in some cases are close as 70-millionths of an inch. Extremely sensitive performance requirements demand flawless workmanship and quality control of the highest order.

Pierce facilities and experience are available to you . . . in the manufacture of high production small mechanical assemblies (machine work and assembly) . . . precision machining of mechanism castings and fabrication of small stamped parts and assemblies.

Your inquiry will receive immediate attention. Write to Chief Production Engineer,

The PIERCE GOVERNOR CO., Inc., Box 1000, Anderson, Indiana

"World's Most Experienced Governor Manufacturer"

New Members Qualified

These applicants qualified for admission to the Society between Sept. 10, 1952 and Oct. 10, 1952. Grades of membership are: (M) Member; (A) Associate; (J) Junior; (SM) Service Member; (FM) Foreign Member.

Baltimore Section

Clyde N. Castle (M).

British Columbia Section

Ralph Benjamin Kelleway (A).

Buffalo Section

Donald L. Coovert (A), Richard D. LeClair (J), Stanley F. Lewinski (J), William A. Little (A).

Canadian Section

George Edward Addy (J), Roy E. Brown (M), Charles Eder (M), George P. Henderson (M), Lewis Garden (M), Eric G. Haynes (A), John Geoffrey Holland (J), Kenneth William Jay (M), William Ashton Lovell (A), Zygmunt Karol Smolana (M), William Stirling (J), S. A. Taylor (A).

Central Illinois Section

James W. Cambron (M), R. B. Cambron (J), Delwin E. Cobb (J), George Adelbert Fisher (J), John Gilbert Hamner (M), William G. Loveridge, Jr. (J), R. R. McCutchen (J), John Franklin Morgan, Jr. (J), Milford B. Morgan (M), Jimmy D. Myers (J), Louis B. Neumiller (M), Richard O. Probst (J), Norwood L. Snowden (M), Howard T. Thistlewood (J).

Mid-Michigan Section

William E. Barnes (M), Richard W. Dymond (J), Clinton C. Poellet (J), Floyd Waters, Jr. (J).

Chicago Section

Harold Austin Brainard, Jr. (J), David J. Calder (A), Richard Allen Dutton (J), Allyn R. Erickson (J), William F. Gehle (A), Orville F. Genz (A), Russell A. Graham (M), Richard G. Hudson (A), Ernest J. Klimczak (M), Paul Otto Nelson (J), Peter Panayot Novas (J), Otis A. Schmidt (J), Edmund J. Sebastian (J), Norman C. Steinberger (J), Lester H. Thorson (M), Jerome W. Tiskus (J), Ronald Watson (J), Robert B. Wright (M).

Cleveland Section

Frank J. Ambrose (M), Martin L. Brody, Jr. (M), Joseph A. Corsillo (J),

Continued on Page 128

UNITED SPECIALTIES *Pre-Cleaner*

Advance Guard

ON YOUR AIR CLEANER TEAM

ELIMINATES

DUST • CHAFF
BEAN FUZZ

SAVES OIL

UNITED PRE-CLEANER
DUST LEVEL
IMPORTANT
THIS PRE-CLEANER DOES NOT ELIMINATE SERVICING OF THE OIL BATH AIR CLEANER, BUT PROLONGS THE SERVICE PERIOD.
EMPTY WHEN DUST LEVEL IS REACHED REMOVE WING NUT ASSEMBLY AND LIFT PLASTIC BODY FROM BASE, SHAKE DUST FROM DIRT COMPARTMENT, AND REPLACE CLEANER.
UNITED SPECIALTIES CO., Chicago, Ill., U.S.A.
DUST LEVEL

United Specialties Pre-Cleaner is easily attached — has a transparent dust chamber — reduces air cleaner servicing frequency — saves oil — fits practically any center tube air cleaner.

To provide full protection UNDER EXTREME DUST CONDITIONS, an air cleaner needs a teammate — a United Specialties Pre-Cleaner to remove a large percentage of dust before it reaches the air cleaner. This prevents the air cleaner from clogging — permits it to operate at full efficiency.

This extra pre-cleaner protection is most essential for machines which consistently work in dust and chaff-laden air — such as wheel tractors, agricultural implements, industrial power units —wherever the dust conditions are particularly acute. If your product is in any of these groups, it will pay you to investigate the United Specialties Pre-Cleaner. Our sales engineers will be happy to provide full details.

UNITED SPECIALTIES COMPANY

United Air Cleaner Division — Chicago 28
Mitchell Division — Philadelphia 36
Birmingham 11, Alabama

AIR CLEANERS • METAL STAMPINGS • ROLLED SHAPES
IGNITION AND TURN SIGNAL SWITCHES • DOVETAILS

New Members Qualified

continued

Joseph C. Donato (A), Mike A. Hernandez (A), Peter M. Kuchling (A), Howard Otto Mielke (J), Wade Hampton Moore, Jr. (J), Percy H. Neville (M), Eugene Andrew Reitz (J), Jack F. Smole (A).

Colorado Group

Lawrence A. Platt (M).

Dayton Section

Raymond Vincent Adams (J), Edward F. Mersereau (J), Thomas Edward Morton (A), Edwin L. Shaw (M), Glenn W. Somers (A), Robert James Tatge (M), Leo Alfred Wack (J), B. R. Winborn, Jr. (M).

BEYOND COMPARE

THE FINEST GENERATING AND STARTING EQUIPMENT MADE!

Leece-Neville

L-N GENERATORS are proving their superiority over conventional standard equipment on thousands of jobs. For 6 and 12 volt systems. High output, long life, reliable performance.

L-N CRANKING MOTORS

High torque, fast cranking speed guarantee quick starts even with cold, stiff engine. For 12 volt and 12-24 volt series-parallel systems. Also higher voltages.

L-N ALTERNATORS

For short runs, long idling, heavy current needs, nothing equals the L-N AC-DC Alternator System. 25 to 35 amps idling! To 80 amps for 6 volt systems; to 175 amps for 12 volt. Also higher voltages.

★ Now producing cranking motors, generating systems, pump motors and special equipment for military engines.

For all the facts, write THE LEECE-NEVILLE COMPANY, Cleveland 14, Ohio
Distributors in principal cities... Service Stations everywhere

YOU CAN RELY ON Leece-Neville

HEAVY-DUTY ELECTRIC EQUIPMENT FOR OVER 43 YEARS

TRUCK BUS DIESEL OFF-HIGHWAY PASSENGER RAILROAD MARINE INDUSTRIAL

Detroit Section

Wm. Leonard Aldrich, Jr. (J), Andrew Badarak (M), Charles Lambert Baker (J), Donald G. Bamford (J), Thomas J. Bischoff (J), Charles Donald Blair (J), Gilbert F. Bonner (M), Burton Hugh Bouwkamp (J), Dr. Frederick W. Bowditch (M), Robert M. Buchwald (J), Ensign George C. Campbell (J), Frederick John Chambers (J), Lillord Cobb (J), Norman D. Cosner (M), James Albert Crabtree (J), David Edward Crockett (J), Ervin A. Domzal (M), Robert L. Emmett (J), Thomas M. Fisher (J), Edward J. Flewelling, Jr. (M), William S. Gale (J), Gerald F. Gass, Jr. (J), E. F. Glance (M), Kenneth K. Hausauer (J), William F. Hayes (J), Lyle L. Jannisse (M), Aloysius John Kaminski (M), William I. Kargela (J), Cecil N. King (M), Alvin Peter Kruthers (A), Harold Erich Kunkel (J), James Richard Landis (J), George Malecki (M), Edgar Richard McPhee (J), Bernard Lynch Metsker (J), Noral A. Nelson (M), Hugh B. Orr, Jr. (J), Edwin J. Piersma (J), Carl Sherwood Rice (M), William E. Rice (M), Paul H. Rofkar (M), Robert E. Spence (J), Charles H. Sumner (A), William M. Swan, Jr. (M), Albert R. Vanderbilt (J), Leroy A. Volberding (M), Edward D. Vosburgh (J), LaVerne R. Voss (J), Robert Gordon Wrinn (J).

Hawaii Section

Ivan B. Palmer (M), Everett C. Watt (M), Robert M. Yamada (A).

Indiana Section

Robert William Bachmann (J), Milton D. Parker (J), Joseph B. Snoy (M).

Kansas City Section

David E. Bloodgood (A), Richard P. Lee (M), Edward J. Weller (J).

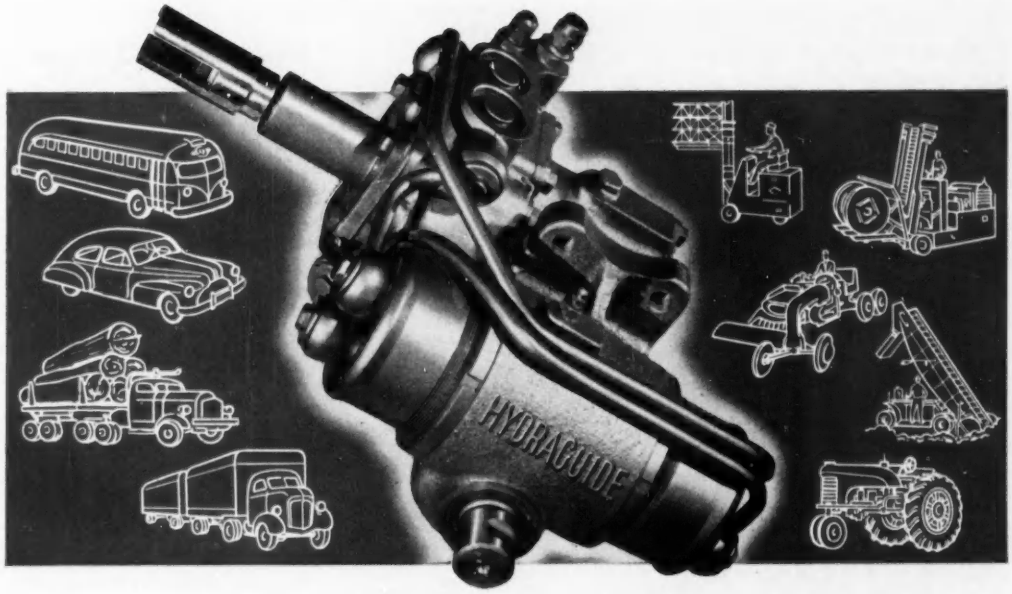
Metropolitan Section

Alan Broder (J), Warren H. Brodie (A), Richard E. Buell (M), Raymond A. R. DeGennaro (J), John Gerard Donovan (J), Col. John S. Griffith (A), Calvin B. Huntoon (A), Harold Frederick MacHugh (A), Ensign James Miller (J), Francis P. Raquet (A), Rudolf E. Rothemund (J), Eldon J. Shorek (J), James E. Vevera (J).

Milwaukee Section

John D. Carlstrom (J), Alton E. Chamberlin (A), T. E. Du Brucq (A), Alvin Palmer Fenton (M), John Robert Liggett (M), Robert George Matters (M), Edward A. Meewes (M), Harold W. Ruf (M), Frederick N. Schmidt (A), Fred W. Schnackenberg (M), William Douglas Smith (J), Robert W. Strehlow (A), Otto F. Widera (M).

Continued on Page 130



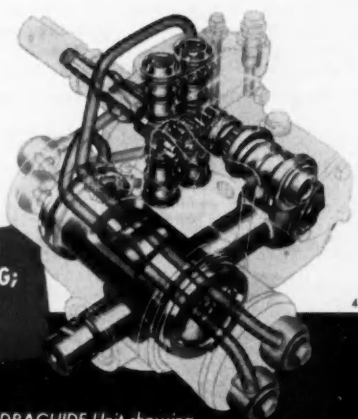
GEMMER HYDRAGUIDE — Hydraulic Power Steering

UNIT TYPE—complete—self-contained—not an accessory or booster, no valves or tubes exposed to snow, ice, mud, gravel, etc. from road. • PROPORTIONAL COMBINATION of hydraulic power and manual steering. • PROPORTIONAL VALVING—power always proportioned to steering load, light or heavy. • VALVES positively actuated—not spring-centered, hence no static load or "valving step" in steering "feel." • Instant response of power—no lag as you move steering wheel. • PERFECT STEERING CONTROL—"road feel" at all vehicle speeds. • FULLY SELF-RIGHTING. • LESS "WINDUP" on steering wheel—higher safe speeds in heavy vehicles. • STEERING WHEEL doesn't "fight" if the vehicle strikes an obstruction or blows a tire. • GEMMER HYDRAGUIDE was the first successful power steering for passenger cars. HYDRAGUIDE for heavy vehicles is the ultimate for buses, trucks, road machinery, and other heavy units. With reasonable care a Gemmer Steering Gear will last the life of the vehicle.

GEMMER MANUFACTURING CO.
6400 Mt. Elliott • Detroit 11, Michigan

The Ultimate In Power Steering

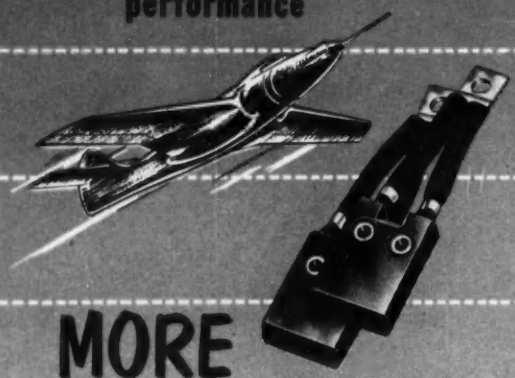
HYDRAGUIDE®



4881

HYDRAGUIDE TAKES THE "STEER" OUT OF STEERING; THE DRIVER GUIDES THE VEHICLE INSTEAD.

Phantom of HYDRAGUIDE Unit showing exclusive proportional valving.

70,000 ft.
STACKPOLE
brushes
60,000 ft.
...Tops for high-altitude performance
50,000 ft.

40,000 ft.
30,000 ft.
MORE
amperes per square inch!

Remember less than 10 years ago when generator brushes that served faithfully on earth surface machines gave out in 2 or 3 hours flying time at 30,000 feet or higher?

Then came the first really dependable high-altitude brushes made by Stackpole. In short order, high-altitude brush life was advanced from 2 or 3 hours to 2,000 or 3,000 hours—*or more!*

Today, with altitudes of 50,000 feet or higher, and high rotating speeds, Stackpole brush engineering continues to pace the progress in this essential phase of aviation development. Stackpole brushes handle current densities as high as 150 to 200 amperes per square inch on generators, inverters and other equipment—with many successful intermittent-duty applications of 500 amperes per square inch. By comparison, difficult industrial applications seldom call for more than 75 amperes per square inch!

(Stackpole brushes are sold only as original equipment—not as replacements)

Difficult earth-surface brush problems solved!

Stackpole high-altitude brush principles likewise offer many advantages on difficult earth-surface applications—especially where atmospheric problems, chemical fumes or other adverse conditions are involved. In a high percentage of such cases, they have resulted in longer brush life, minimized commutator wear and higher equipment operating efficiency.

STACKPOLE CARBON COMPANY • St. Marys, Pa.

BRUSHES FOR ALL ROTATING ELECTRICAL EQUIPMENT · CARBON, GRAPHITE and PRECIOUS METAL CONTACTS · BEARING MATERIALS · BRAZING FURNACE BOATS · CARBON PILES · CLUTCH RINGS · CONTINUOUS CASTING DIES · DASH POT PLUNGERS · ELECTRIC FURNACE HEATING ELEMENTS · FRICTION SEGMENTS · RESISTANCE WELDING TIPS · CHEMICAL CARBONS, etc.

New Members Qualified

continued

Mohawk-Hudson Group

P. H. Keenan (A).

Montreal Section

George Bisson (M), G. E. James Blaiklock (J), Norman Edward Delmage (M), Edward Needham (M).

New England Section

Secor D. Browne (M), Arthur C. Herrington (J), George S. Wentworth (S M).

Northern Calif. Section

H. B. Clary (M), Robert H. Gray (M).

Philadelphia Section

Raymond George Frank (J), Joseph A. Gunning (M), Sigurd E. Jacobson (A), Edward M. Kintz (M), James Howard Leggoe, Sr. (J), Walter Van Ness Pruyn (M), George J. Reed (J), Louis A. Rosser (A), F. Howard Shank (A), James Clark Shoffner (J), Joseph Currier Towle (M).

Pittsburgh Section

John A. Beck, Jr. (M).

St. Louis Section

Tapley F. Daugherty (J), Harold Hertenstein (M), Kenneth E. Koza (J), James G. Lewellen (J).

Salt Lake City Group

Leonard J. Giacomozzi (A), Richard S. Love (A).

San Diego Section

John Michael Cleary (M), Robert Ely (M), Charles Morgan (M).

Southern Calif. Section

Gerald J. Brentnall (A), Frank B. Bruce (M), A. J. DeMers (M), James I. Detweiler (M), Henry Dreyfuss (M), Jarrott Val Flowers (J), Daniel James MacLean (M), Harry T. MacMillan (A), John Rendall Mooney (J), Normand Evan Morgan (J), O. A. Wheelon (M).

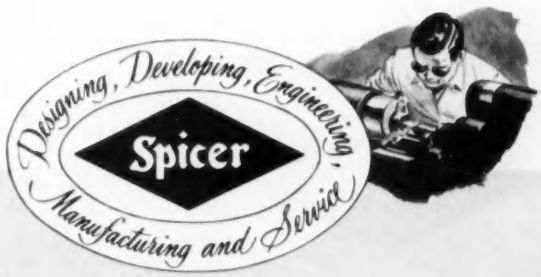
Texas Section

Howard E. Campbell (M), Joseph Anthony Canavespe (J), Owen L. Metcalf (M), Hollis W. Smith (A), William L. Taylor (J).

Continued on Page 133

More lives than a Cat

It is typical of Spicer automotive power transmission units to keep alive and operating under years of heavy service. Spicer builds nearly a half-century of designing and manufacturing experience into its products. And backs these products with a service policy that assures long-range protection to the user. Spicer facilities are the most modern and efficient in the industry, and are available in their entirety to you.

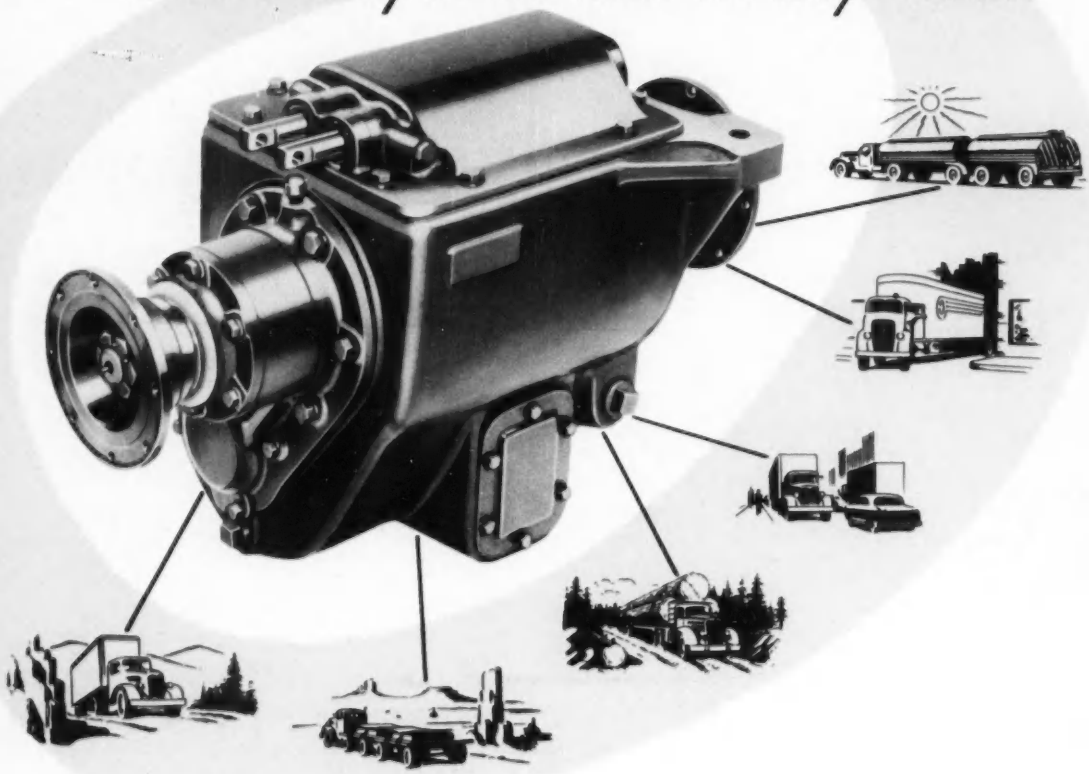


Spicer

SPECIALISTS IN SERVICE

Spicer Auxiliary Transmissions

reduce cost per-ton-mile on any terrain



Increase the earning power of your vehicles with Spicer Brown-Lipe 3-Speed Auxiliary Transmissions. They assure more pulling power in underdrive gears. They increase truck speed in overdrive gears, while reducing engine revolutions.

Every unit—motor, clutch, transmission, drive shaft, axle, brakes, tires—operates with less strain with a Spicer Brown-Lipe Auxiliary. Operators are assured less down time; fewer repairs; reduced gas, oil and tire bills; more consistent and bigger payload income.

Let Spicer engineers help reduce cost per ton mile in your vehicles with Spicer 3-Speed Auxiliary Transmissions.

48 YEARS OF Spicer SERVICE

SPICER MANUFACTURING

***Division of Dana Corporation* • TOLEDO 1, OHIO**

TRANSMISSIONS • UNIVERSAL JOINTS • BROWN-LIPE AND AUBURN CLUTCHES • FORGINGS • STAMPINGS
PASSENGER CAR AXLES • SPICER "BROWN-LIPE" GEAR BOXES • PARISH FRAMES • TORQUE CONVERTERS
POWER TAKE-OFFS • POWER TAKE-OFF JOINTS • RAIL CAR DRIVES • RAILWAY GENERATOR DRIVES

New Members Qualified

continued

Southern New England Section

Harry Richardson Haynes (A), Robert Charles Meyer (J).

Twin City Section

H. Bruce Hoesly (M), Leslie Wyatt Foster, Jr. (J), Orien A. Kruse (J), Otis Mason (M), Raymond O. Overby (M), K. C. Paape (M).

Virginia Section

T. W. Curry (M).

Washington Section

Joseph A. Alber (J), William A. Summerson (J).

Wichita Section

Harold C. Goldthorpe (M), Donald E. Mead (J).

Williamsport Group

Donald E. Dahlberg (J).

Outside of Section Territory

George H. Aitken (A), Leon G. Alexander (M), Halswelle W. Hadden (M), Clayton Ralph Chaminade (J), Eugene M. Krawczonek (J), Robert W. Meyer (J), Seaton Moon, Jr. (J), Sydney A. Olsen (J), Curtis F. Sasserson (M), James Joseph Somers (A).

Foreign

A. M. McCollister (M), Germany; Franco Pinolini (F M), Italy; Carlo Pollone (F M), Italy; Samuel Edward Cecil Soysa (F M), Ceylon.

Applications Received

The applications for membership received between Sept. 10, 1952 and Oct. 10, 1952 are listed below.

Atlanta Group

Kenneth M. Brooks, Wallace Asbury Hanson, Jr., Fred L. Weinheimer, Jr.

Baltimore Section

Paul Harry Cromwell, Edwin R. Larson, Paul W. Wheeler.

British Columbia Section

Alan L. Bingham, Hugh Coleopy, John Holdsworth, James McGown, Jr.

Buffalo Section

Frederick J. Kneisler, William F. Milliken, Jr., Charles H. Sweatt, Ralph H. Wilson.

Canadian Section

Bruce R. Aubin, Nels Anthony Dario, Ernest R. Gifford, John C. Hastings, Michael Owen Jones, Alexander H. McCuaig, John Hideo Miura, John C. Muirhead, Thomas Melville Patterson, Lester Gray White, C. R. Matthews.

Central Illinois Section

Frederick William Beyer, Jr., Donald Edvin Cain, Floyd S. Dadds, Harold C. Davidson, Franklin O. Koch, Jr., Roger H. Williams, Maurice E. Young.

Continued on Page 134

Only the Tung-Sol Signal Flasher provides this three-way warning for automotive uses—ahead—behind—and on the instrument panel. The important instrument panel pilot light tells the driver his signals are operating, or, by not flashing, warns him of a circuit failure.

More than 13,000,000 Tung-Sol Signal Flashers have been used and they usually outlast the cars they're on.

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continued

Chicago Section

Charles M. Atterbury, John Robert Bowling, Chester J. Cole, Richard John Eisenach, William Courtney Files, Werner A. Gans, Harold A. Grenert, Marcus Walter Hagen, Fred Willard Haney, Jr., David Lloyd Hanson, Irwin Jacobson, Martin E. Keane, Walter Kocolowski, Gordon LeRoy Knudson, Ralph E. Lambrecht, Francis P. Luzzo, George R. Ondeck, Jr., Jerry F. Pavelka, James J. Powlas, Robert J. Schroeder, J. H. Spence, John P. Walsh.

Cincinnati Section

Joseph S. Alford, Peter W. Dwyer, Robert Nelsen, Vernon T. Nugent, Ralph J. Schmidt, Jack J. Stilson, Ralph W. Woods.

Cleveland Section

Robert Banks, Albert Edward Boffey, Lester F. Burdoff, Reuben C. Carlson, Elias L. Corpas, Frank A. Flower, Clifford E. Heindenreich, William W. Kirk, Maurice E. Kline, Paul H. Kramer, Vincent T. Marusa, Rudolph J. Menart, Charles L. Moon, Jerry R. Mrlik, George M. Perry, Clarence L. Playford, Edward John Ratkay, David E. Reyna, Albert P. Rogel, Herbert E. Sietman, Bernard A. Spon, Walter Martin Waldbauer, William A. Weinkamer, Louis C. Wolff, John H. Waldorf.

Colorado Group

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Dayton Section

Warren G. Craig, John William Fulton, Paris C. Paraskos.

Detroit Section

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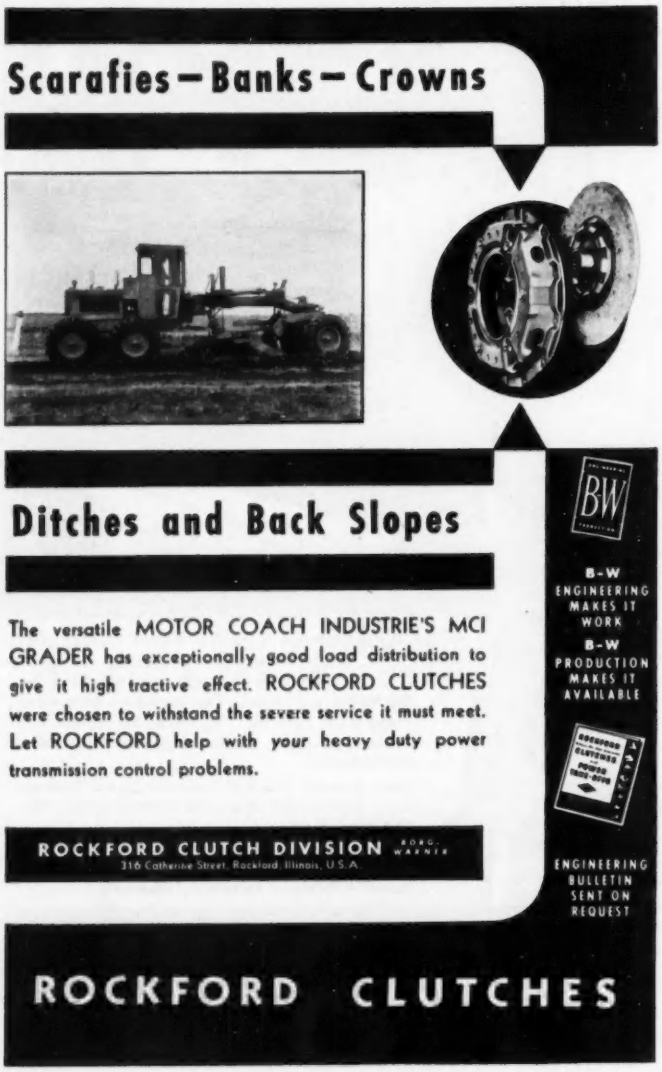
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. . . will soon result from Harvey Aluminum's close alliance with the Air Materiel Command's HEAVY PRESS PROGRAM.

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TORRANCE, CALIFORNIA
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William L. Adkins, Burl B. Baber, Jr., Paul L. Bracht, Robert Martin Crow, Fred F. Fox, Richard O. Mason, Ross Wilson McCormick, Richard O. McHenry, Donald G. Stong, Francis Anthony Urbaniak, George L. Webb, Michael Zoretich, Jr.

Kansas City Section

John W. Brooks, Fred H. Bunts, A. M. Cole, Hubert M. Fayman, Donald Everett Flick, Merlin D. Howard, Arthur N. Knudsen, Ben D. Mills, James J. Paye, Kenneth Allen Orear, Davon Bland Pierce, Daniel H. Smith, Andrew J. Sutton, Richard C. Fuller.

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Parker M. Bartlett, Frank R. Cassel, Leao Goncalves DeOliveira, John J. Duzich, John E. Epprecht, Morton S. Feinsilver, John J. Flannery, Jr., Robert E. Franseen, Charles Frendock, Richard W. Heidersberger, Norbert J. Hertel, Michael Kowalchik, Ivar F. Larsson, George A. Metz, John A. Mowbray, Raymond G. Newman, Peter G. Nicholas, John J. Pietruszkiewicz, Felix P. Pongrac, Jr., George Charles Skillman, Jr., Anthony J. Suchoski, Michael J. Tomich, Homer U. Tsakis.

Mid-Michigan Section

Robert W. Chase, Robert J. Ferguson, Robert M. Gold, Eugene Gottschalk, Norton Nichols, Raymond Joseph Schultz, Wayne H. Watling.

Mohawk-Hudson Group

William H. Radtke, Rene Antoine Toesca.

Milwaukee Section

Harold W. Buenger, Gordon C Rucks.

Montreal Section

Jean C. Paolucci, Rodolphe Ernest Loiselle, John McNeill, Jan Murer, Morris Conroy Shonfield.

Northern Calif. Section

Lyle O. Bowman, Donald Earl Carrington, Sidney E. Cochran, Albert R. Davidson, Jr., W. A. Knuckey, Donald A. Murray, Carl William Rhodin.

New England Section

Wilbur Edmund Bassett, Harry Paul Boyden, Bruce C. Center, Ross Stuart Karlson, Raymond A. Swanson, Hans Ulrich Wydler.

Northwest Section

John W. Anderson, Woodburn Allen "Tex" Brown, Sidney F. Cox, William F. Driver, Milton B. Hammond, Jr., Hal S. Huskinson, Walter Mark Isaac, Gerald Michael Lefoley, Alvin H. Rand, Earl C. Reed, John Joseph Zajac.

Oregon Section

William C. Kieling.

Philadelphia Section

H. L. Decker, Vincent E. DiLucia, Robert Henry Fritzges, John Joseph Geohegan, Edward Francis Gowen, Oliver M. Hahn, Bennett D. Jones, C. Clark Kenlan, Richard Henry Marvin, Alden J. Pahnke, Gordon Walter Woods, James O. Yule.

Pittsburgh Section

Earl Allan Bake, Donald E. Foringer, John Charles Konkler, Joseph B. Lasky, Wiliam J. Masters, George C. Schrade.

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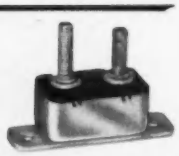

Fasco Automotive Reset Circuit Breaker

Fasco Hydraulic Stoplight Switch

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Tiny FASCO parts help build BIG reputations . . .

Some of the smallest parts are big factors in helping a car earn and keep a good reputation.

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Applications Received

continued

St. Louis Section

Robert E. Coughenour, Stanley C. Harrington, Charles R. Remington, Jr.

San Diego Section

James E. Chinnis, William O. Edell, Merwyn O. Faiman, Henry Poniktera, Andrew Segal, Gerald A. Vroman.

Southern Calif. Section

Robert Clarence Allen, Arthur R. Beckington, John A. Best, Eugene Norman Borson, Donald E. Bowman, Selby W. Brewer, Jean Clail DuBuisson, Joseph Rudolph Faitel, Robert E. Frederickson, Richard B. Huntington, Eastman N. Jacobs, Alfred J. King, O. Allen Knuusi, S. Richard Krown, Satoshi Nitta, Gerald Clark Potvin, Robert Allen Ross, Andrew L. Savulak, Michael M. Schuster, Jesse R. Smith, Paul F. Smith, Roy E. Steinhoff, Earl Edwin Vipond, Robert Joseph Von Flue, Eugene W. Waterbury, Jerome LeRoy White, Robert Edward Wieneke, William Marden Willis.

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Spokane-Intermountain Section

Robert H. Briscoe, George C. Fuller, Carrol Eugene Peck.

Syracuse Section

John Taylor Davidson, Burton D. Jones.

Texas Section

Joseph J. Ciesla, Lawrence C. Hickman, Robert Max Hooks, Elliott L. Hovel, Glen W. Putney, Learon R. Shankle, David C. Spraker, William Merrick Tisdale, H. Patrick Warren.

Twin City Section

Joseph H. BeVier, Robert DeGhetto, Dale W. McKee, Joseph D. Menth, Edward R. Sewall, Robert W. Thornburg, Quentin I. Wilcox.

Washington Section

Lynn L. Bradford, Melvin Neilson Gough, Lt-Col. Anthony D. Nelson.

Western Michigan Section

Clarke T. Goethel, Howard B. Yarbrough.

Williamsport Group

Franklin S. Frederick, Paul G. Mays.

Outside of Section Territory

Frederick George Baily, Russell L. Dahl, Jack Andrew Fleming, Ralph John Gimera, Jack E. Gregg, Robert S. Jacobus, Edmund G. Janssen, Jr., Gerald Joseph Kuchera, Thomas Linder, Jr., Charles G. Moore, Jr., Lawrence E. Palatnik, James Floyd Pope, Edward Hall Rayermann, James Pruett Whitman, Robert Glenn Woodward.

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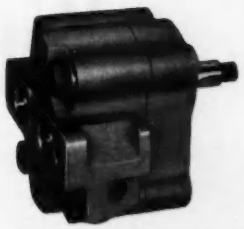
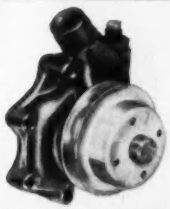


FARM IMPLEMENT PUMP



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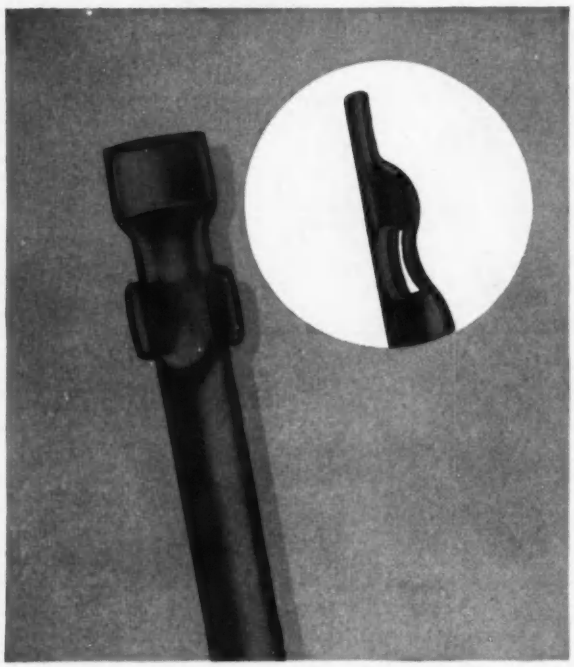


1. DESIGN SAVINGS

Doing everything possible to meet original customer specifications is a Bundy *must*. Yet Bundy engineers can often point out design improvements and fabrication savings. Above: vent tube, as specified, for use inside gasoline filler tube. Problem was to remove possibility of gasoline entering two side vents as gas tank was filled.

Above: Improved design suggested by Bundy engineers completely protects vent from gasoline entry by baffle deflection. More, this part requires just two operations: one to flatten end and pierce tube simultaneously, one to put double bend in flattened end. For customer, new design meant better function at lower part cost.

Bundyweld Tubing®

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of copper-coated steel. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Copper coating fuses with steel. Presto . . .

Bundyweld, double-walled and brazed through 360° of wall contact.

← **NOTE** the exclusive patented Bundyweld beveled edges, which afford a smoother joint, absence of bead and less chance for any leakage.

Bundy Tubing Distributors and Representatives: *Cambridge 42, Mass.:* Austin-Hastings Co., Inc., 226 Binney St. • *Chattanooga 2, Tenn.:* Poirson-Deakins Co., 823-824 Chattanooga Bank Bldg. • *Chicago 32, Ill.:* Lapham-Hickey Co., 3333 W. 47th Place • *Elizabeth, New Jersey:* A. B. Murray Co., Inc., Post Office Box 476 • *Philadelphia 3, Penn.:* Rutan & Co., 1717 Sansom St. • *San Francisco 10, Calif.:* Pacific Metals Co., Ltd., 3100 19th St. • *Seattle 4, Wash.:* Eagle Metals Co., 4755 First Ave. South *Toronto 8, Ontario, Canada:* Alloy Metal Sales, Ltd., 181 Fleet St., East • **Bundyweld nickel and Monel tubing is sold by distributors of nickel and nickel alloys in principal cities.**

tubing buy on every count

You buy unmatched tubing features, priceless safe performance, *plus* cost-paring engineering skills when you specify Bundyweld Tubing.

You get *more* for your tubing dollar when you specify Bundyweld for automotive fuel lines, oil lines, hydraulic brake lines.

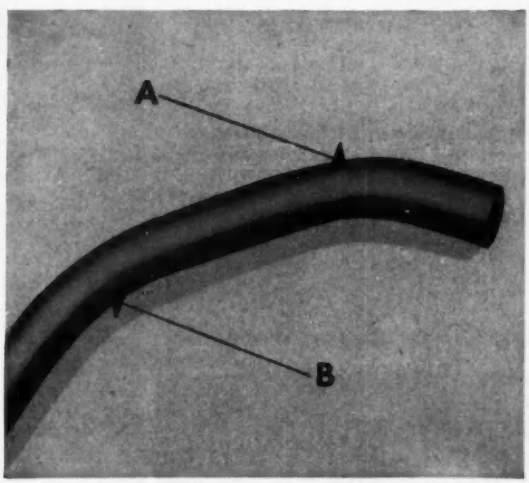
You buy unequalled tubing features. Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, highly resistant to vibration fatigue, lightweight, yet stronger.

You buy tubing performance that has made Bundyweld a byword for safety and dependability, proved by the 360,000 miles of Bundyweld used in cars, trucks and buses since 1930.

More, you buy the industry's finest skills and services. Bundy engineers help you work out the easiest, most economical way to produce new tubing parts; often save money by showing you how to use less tubing, how to make production short cuts. If you wish, Bundy will take over complete fabrication of your tubing parts — produce them as specified, deliver them on time.

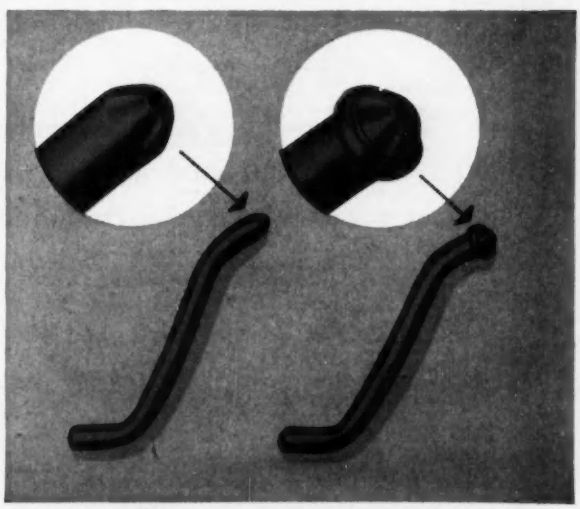
Whether you prize safe performance or cost-cutting engineering skills, specify Bundyweld . . . and you'll buy both.

Contact a Bundyweld Distributor (listed lower left), or write direct to *Bundy Tubing Company, Detroit 14, Michigan*



2. COST SAVINGS

Bundy engineers are always on the lookout for new ways to shave costs. For example, the 7/16"-O.D. oil tube shown above required two bends, yet both ends had to be held to exact size. The nearness of Bend A to the end of the part made holding of exact size difficult. Bundy engineers went right to work on the problem, came up with *results*: bending and sizing were combined in one press operation for high-volume production, lowered costs. Specify Bundyweld and you tap engineering skills dedicated to paring costs, whether you fabricate tubing parts or Bundy fabricates them for you.



3. FABRICATION SAVINGS

The 3/16"-O.D. timing-gear oiler tube shown above required tapered end for a nozzle effect. As specified by customer (left), it required numerous swaging operations. With customer's consent, Bundy added upset to nozzle tip (right). As a result, nozzle-forming operations were cut in half. But Bundy bird-dogging didn't stop there. Two hand-bending operations were incorporated into one automatic press operation. The over-all result: impressive fabrication savings to the customer, with no compromise in tubing function.

The Crankshaft
—backbone of the internal combustion engine.

Modern Trends—more r.p.m.'s, higher compression ratios, more power per cubic inch of displacement—all lend additional emphasis to the importance of crankshaft quality.

Wyman-Gordon Experience—the most extensive in the industry, assures the maximum in physical properties, uniform machinability, and balance control.

Standard of the Industry for More Than Sixty Years

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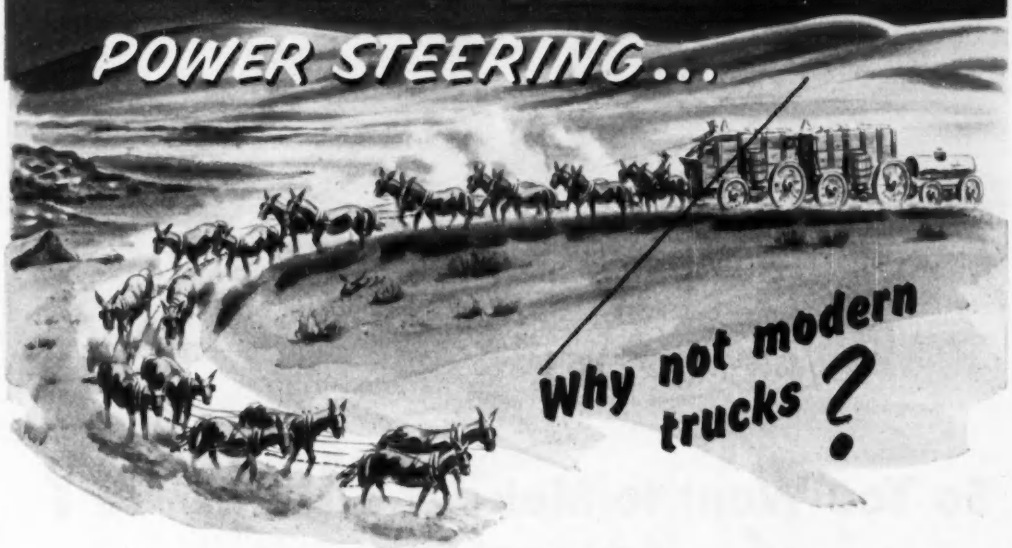
20-mule team wagons had POWER STEERING...



As the primitive 20-mule team wagons loaded with borax creaked their way 167 miles out of the bitter wastes and murderous heat of Death Valley, the drivers had the benefit of power steering. The mules furnished the power for steering as well as propulsion of the two 4-ton wagons. The driver only guided the mules.

Today's truck transport is generally superior in every way but one. Too often the far heavier manual steering load is on the arm, shoulder and back muscles of the driver. This tiring work slows him down, reduces his efficiency, makes him "accident-prone."

Vickers Hydraulic Power Steering makes the heaviest vehicle almost effortless to steer . . . even under the brutal conditions of nearly roadless deserts like Death Valley. A light finger touch is enough. Ruts, soft shoulders, obstructions, flat tires, off road conditions cannot cause wheel spin or loss of control. Steering no longer fatigues the driver—he remains fresh, efficient, safe.

For further information on Vickers Hydraulic Power Steering, ask for Bulletin M-5100.

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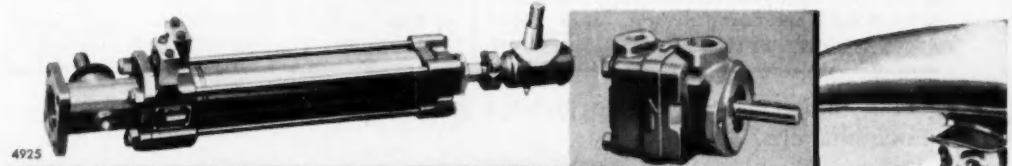

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POWER STEERING
Is Effortless, Positive and Shockless

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2. Make 1,000,000 small stampings a day with only *one* grind per day.
3. Save $56,907 annually by using Carmet, as shown in the following cost comparison:

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★ 4½ Dies per year	$30,600	★ 22 Dies per year	$ 46,750
★ Punch Replacements per year	$(none)	★ Punch Replacements per year	$ 6,600
★ 260 Grinds per year	$14,560	★ 4,420 Grinds per year	$ 47,424
★ Diamond Wheel Cost per year	$ 792	★ Abrasive Wheel Cost per year	$ 2,085
ANNUAL COST WITH CARBIDE	$45,952	ANNUAL COST WITH FERROUS	$102,859

4. Make millions *more* precision pieces a year than you could with hi-carbon, hi-chrome dies!

Ask the Carmet representative to figure out the potential savings and increased production for you in terms of your own work. ● *Allegheny Ludlum Steel Corporation, Carmet Division, Wanda & Jarvis Avenues, Detroit 20, Michigan.*

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Exceed latest S.A.E. Specifications — State Approved • Tested by Electrical Testing Laboratories, Inc. • Scientifically Designed Stimsonite Lenses

SLIM	2⅛" in depth
SLEEK	No openings to let in water and dirt
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SWITCH	Burn-out proof, self-cancelling or non-cancelling
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THE REGULAR MODEL DIETZ CLASS "A" TYPE 1 DIRECTION SIGNALS

Lower price model featuring Stimsonite Lenses, single hollow stud mounting, snap ring lens retainer. Available with burn-out proof, self-cancelling or non-cancelling Switches.

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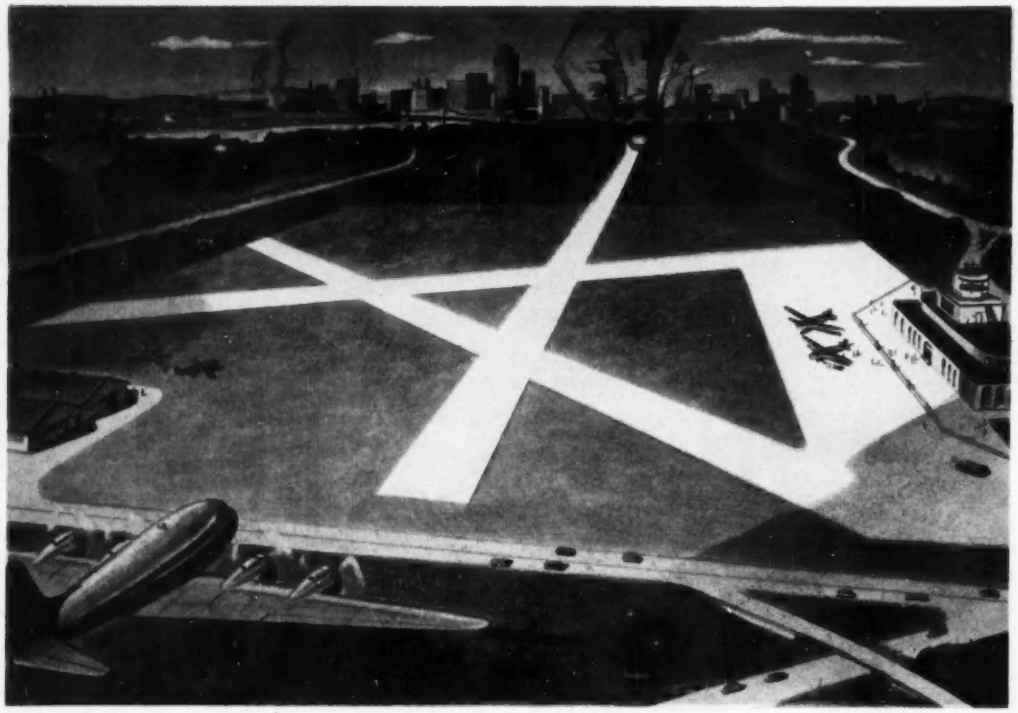

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LIGHTWEIGHT—SIMPLE—FOOLPROOF—POSITIVE MECHANICAL LINKAGE INSTALLATION

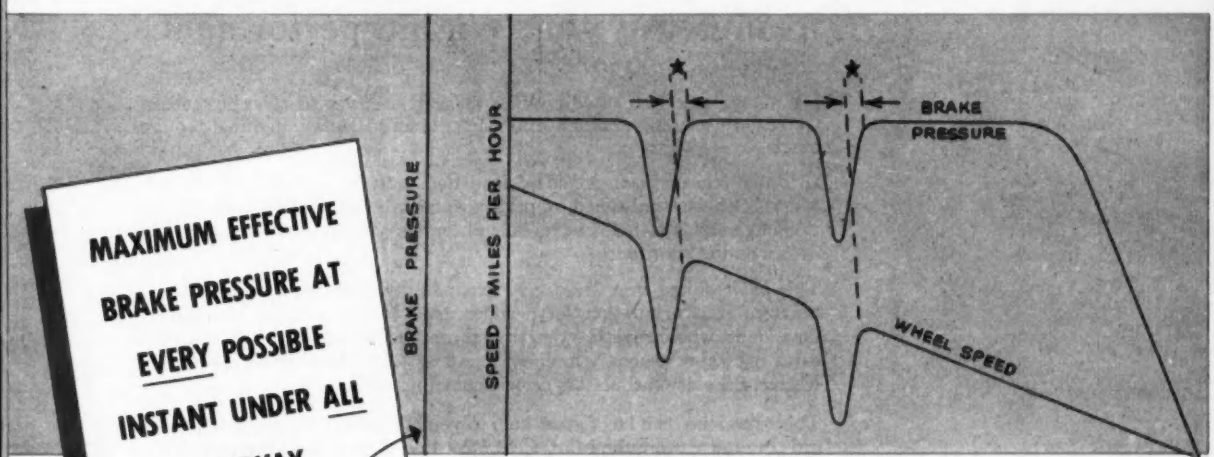
This device is designed for smallest possible size, lightest possible weight, complete simplicity and top dependability. There are no delicate parts, no complicated mechanisms.

Aircraft Section
Industrial Products Division

Controller Brake Equipment

ELIMINATES SKIDDING UNDER ALL RUNWAY CONDITIONS

PRODUCES MAXIMUM RETARDATION PERMITTED BY RUNWAY CONDITION... PERFORMANCE PATTERN IS TAILORED TO INDIVIDUAL PLANE CLASSIFICATION



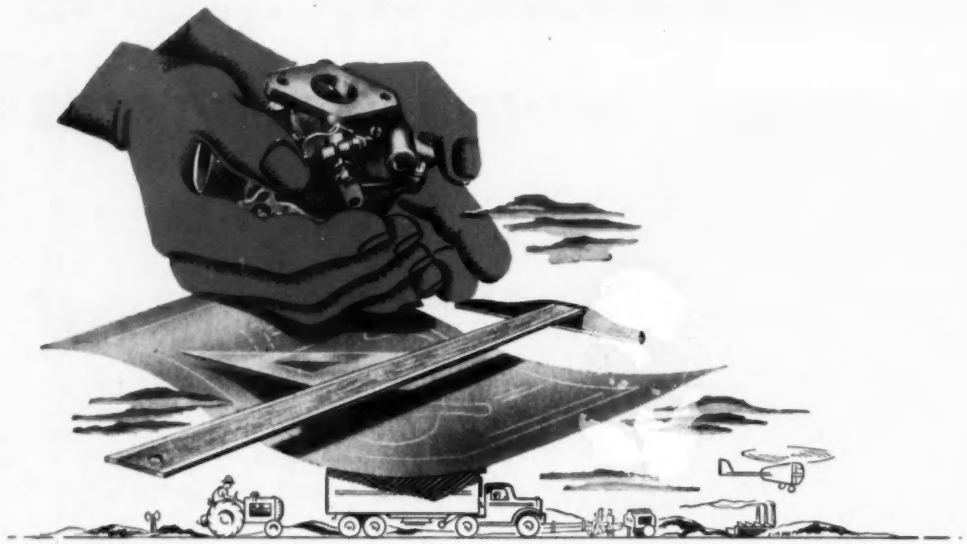
MAXIMUM EFFECTIVE BRAKE PRESSURE AT EVERY POSSIBLE INSTANT UNDER ALL RUNWAY CONDITIONS

This diagrammatic sketch, shows at a glance the full brake pressure provided by the Decelostat's principle of operation. This full brake pressure is maintained at the wheel at all times. The Decelostat eases this pressure to conform to runway conditions—with full restoration as soon as normal adhesion is re-established.

We'll be glad to tell you more about this important Development. Write for Literature.

Westinghouse Air Brake Company

WILMERDING, PA.



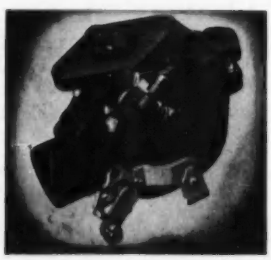
Look to field application engineering to increase your engine performance

For many years, in many diversified markets, Marvel-Schebler has concentrated on designing and adapting carbureters to meet individual requirements.

In order to satisfy all kinds of load demands, in all kinds of weather, Marvel-Schebler has relied on performance data supplied by field application engineering to help engine manufacturers obtain carbureters of proper design and calibration.

This has resulted in a constantly expanding wealth of experience in carbureters and carburetion for a wide range of applications. In the farm field alone, where rugged strength and unusual dependability provide that extra margin of economy in operation, 6 out of 10 farm tractors are using Marvel-Schebler carbureters as original equipment.

This experience can be of great help to you in the proper selection of standard equipment from the Marvel-Schebler line or in any of your carburetion problems. It is yours for the asking.

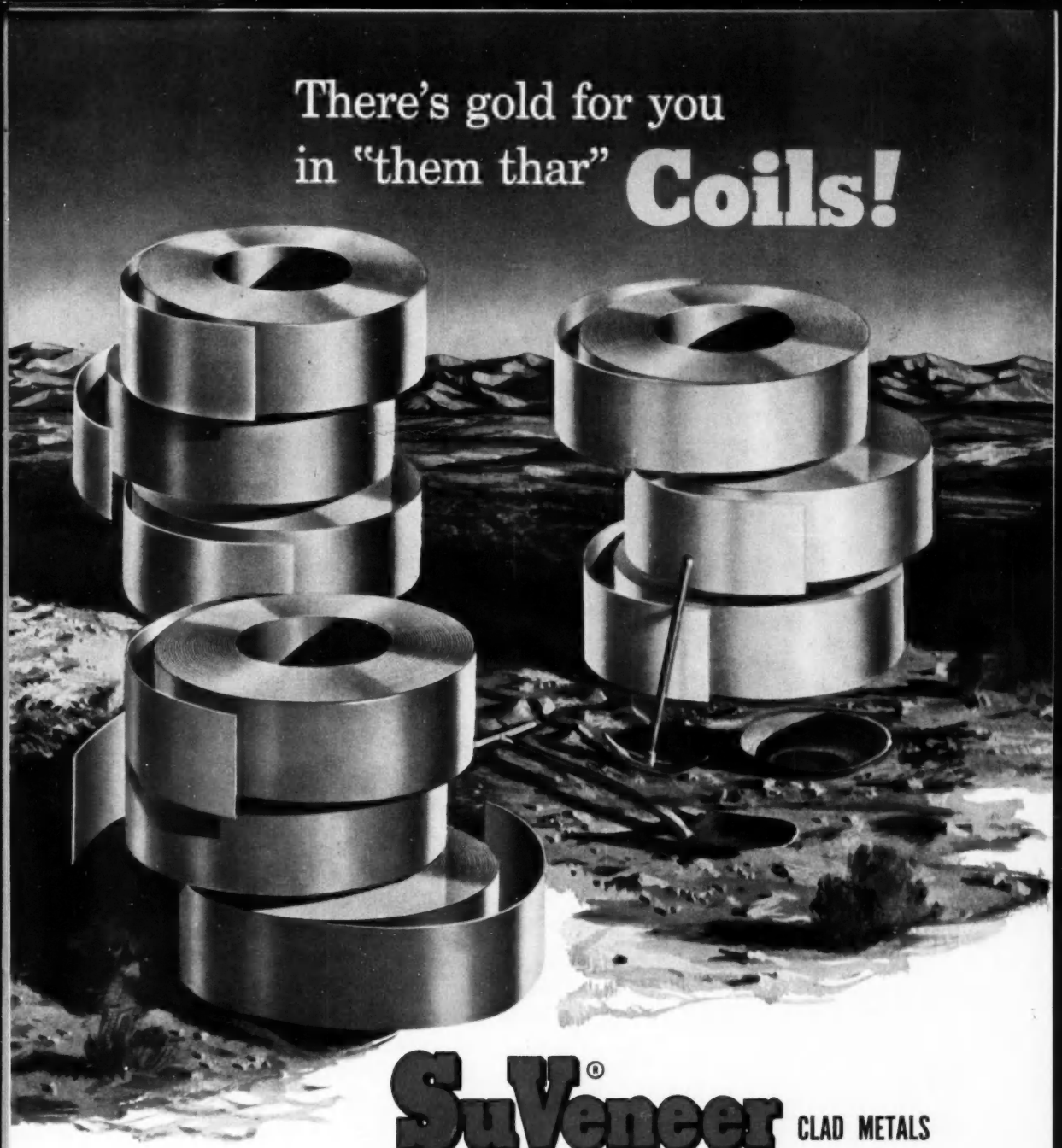


MARVEL-SCHEBLER PRODUCTS DIV.

Borg-Warner Corp., Decatur, Ill.

B-W

MARVEL-SCHEBLER *Carbureters*

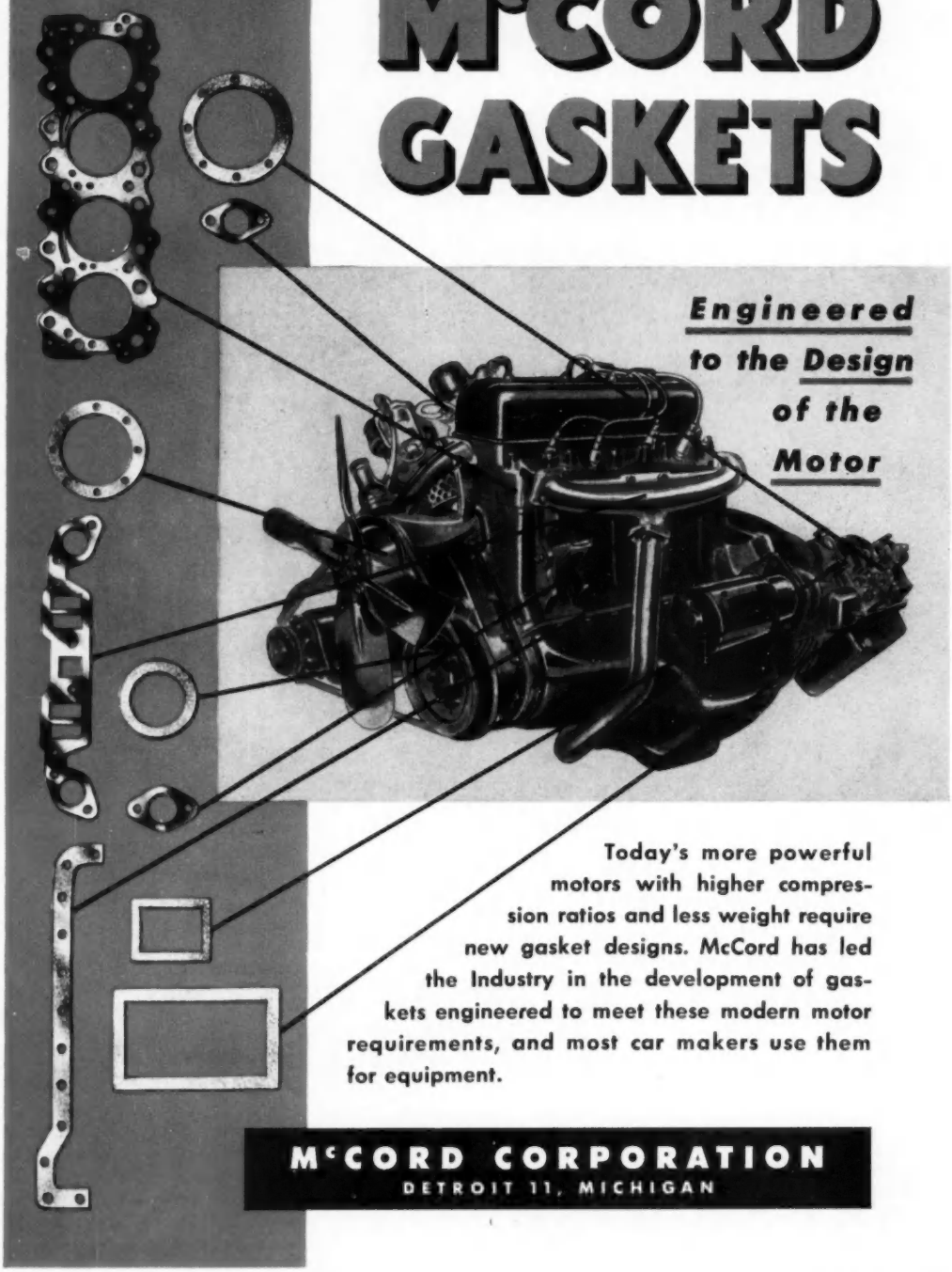


SuVeneer® CLAD METALS

Prospecting for more profitable product fabrication? You're in luck when you find how **SuVeneer** Clad Metals pan-out on your applications . . . in savings of expensive non-ferrous materials, in ease of fabrication, and in improved product performance. **SuVeneer** Clad Metals are composites of genuine copper, or brass, or nickel, bonded inseparably to plain strip steel on one or both sides. ● You save from 70% to 80% of the solid strategic metals, while enjoying *all* their surface advantages. Write!

Superior Steel
CORPORATION
CARNEGIE, PENNSYLVANIA

McCORD GASKETS



Engineered to the Design of the Motor

Today's more powerful motors with higher compression ratios and less weight require new gasket designs. McCord has led the Industry in the development of gaskets engineered to meet these modern motor requirements, and most car makers use them for equipment.

McCORD CORPORATION
DETROIT 11, MICHIGAN

Deadening decibels in the '52 FORD

Have you noticed how much easier it is to carry on a conversation in today's cars? Acoustical engineers have made great strides in eliminating noises we used to associate with motoring.

Sound deadener pads are bonded wherever large metal areas tend to amplify sounds. A special 3M adhesive, for example, holds sound absorbing glass fiber pads on hood and roof panels. These adhesives provide a swift, economical life-time bond, and are typical of the specialized compounds 3M supplies to the automotive industry.

Specialized compounding knowledge coupled with on-the-spot technical service, has made 3M the foremost supplier of adhesive products to Ford and others in the automotive industry. Why not draw upon this reserve of experience whenever you're considering the use of adhesives or sealers? There's a 3M representative calling in your area regularly.

See what adhesives can do for you . . .

Get your copy of our 32-page manual showing typical cost-cutting applications, with description and physical properties of a wide range of adhesives, coatings, and sealers. Write Dept. 911,411 Piquette Avenue, today!

FIFTIETH ANNIVERSARY
3M COMPANY
1902 ★ 1952

ADHESIVES · COATINGS · SEALERS

MINNESOTA MINING AND MANUFACTURING COMPANY

ADHESIVES AND COATINGS DIVISION • 411 PIQUETTE AVE., DETROIT 2, MICH.

GENERAL OFFICES: ST. PAUL 6 • EXPORT: 270 PARK AVE., NEW YORK 17 • IN CANADA: LONDON

MAKERS OF "SCOTCH" BRAND PRESSURE-SENSITIVE ADHESIVE TAPES • "SCOTCH" BRAND SOUND RECORDING TAPE • "SCOTCHLITE" BRAND REFLECTIVE SHEETINGS • "3M" ABRASIVE PAPER AND CLOTH • "3M" ADHESIVES AND COATINGS • "3M" ROOFING GRANULES • "3M" CHEMICALS

It's so comfortable...

SEAT CUSHIONS—BACK SPRINGS

by **Standard Steel Spring Company**

MAIN OFFICE: CORAOPOLIS, PA.

PLANTS: Allegan, Mich. · Gary, Ind. · Chelsea, Mich.
Chicago, Ill. · Logansport, Ind. · Coraopolis, Pa.
Newton Falls, Ohio · Detroit, Mich. · New Castle, Pa.
Los Angeles, Calif. · Trenton, N. J.

DISTRICT OFFICES: 1600 Fisher Bldg., Detroit, Mich.
Peoples Gas Building, Chicago, Ill.

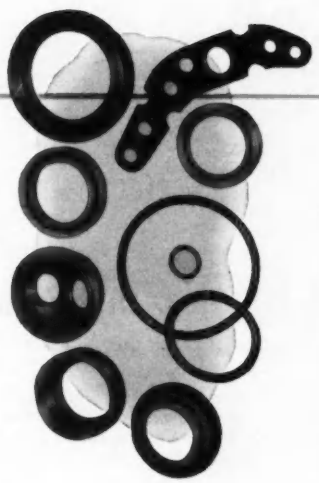
RESEARCH LABORATORY: Coraopolis, Pa.

Products

BUMPERS · UNIVERSAL JOINTS · COIL, PRECISION, MECHANICAL SPRINGS
OPEN STEEL FLOOR GRATING · CORROSIZING · ARMOR PLATE · SEAT CUSHIONS,
BACK SPRINGS · FLAT LEAF SPRINGS · TUBULAR SEAT FRAMES · TUBULAR PRODUCTS

Meet William L. Harris
Superintendent
International Packings Corporation
Affiliated with Graton & Knight Company

Graduating with a B.S. Degree in Chemistry from Hamline University in St. Paul, Mr. Harris has devoted his entire career in the two fields of synthetic rubbers and leathers. As a scientist, the government called upon him as a technical adviser to supervise the GRS rubber program. As a production man, he has served as foreman, production manager, and ultimately as development manager for new and experimental work on mechanical packings and specialties. This background has ideally fitted him for his present job as Superintendent. He knows his materials and what each can do. Equally important he knows how to make these materials into efficient packings.



In this current series of advertisements we want you to meet these men. Their experience is yours to command.

There's practical know-how in the manufacture of packings

The type of packings, the material from which they are made, the treatment given that material are important. At G&K-INTERNATIONAL you'll find a wealth of experience on which to base a wise choice.

Equally important is how these packings are made — the step-by-step adherence to tolerances, both dimensional and physical; the proper sequence given to operations and treatments so as to obtain to the fullest those qualities that mean longer life and more efficient service; and, of course, modern machinery, skilled workmen and intelligent supervision all combined to produce those packings most economically. These production advantages are all yours when you specify G&K-INTERNATIONAL packings.

Let us show you how *your* packings may be made to give *you* longer life and more efficient service. Call in our engineer, give him all the facts about your installation, and our recommendation will follow promptly.

second century G and K – INTERNATIONAL

Leather and synthetic packings

GRATON & KNIGHT COMPANY
Worcester 4, Mass.

INTERNATIONAL PACKINGS CORPORATION
Bristol, New Hampshire

An Extremely Lightweight Blanket Insulation

. . . for effective control of temperature and sound

If you have an application in the transport field that calls for an insulation with the most effective thermal-acoustical qualities, you might well ask these questions about Microlite Glass Fiber Insulating Wool:

Is it lightweight? . . . *24 square feet of half-inch, half-pound Microlite weighs a mere 8 ounces. Large sections can be quickly and easily applied, like a downy blanket. Knife or shears are the only necessary cutting tools.*

Is it permanent? . . . *Microlite is made of glass fibers that resist fire, corrosion, moisture and vibration settling. It does not decay and provides no nutriment for fungi or vermin.*

Does it insulate well? . . . *Inch for inch, Microlite is one of the most efficient of all insulations. 1 lb. density material has a "k" factor of .21 at 75° F. mean temperature.*

Are convenient sizes and types available? . . . *It comes to you in resilient blankets up to 72 inches wide, up to 200 feet long, and up to 3 inches thick; compressed in easily-stored rolls. It may be ordered with foil, reflective coated paper and reinforced or unreinforced paper vapor barriers.*

Perhaps Microlite can help you cut weight and installation costs. For more information and samples, write Glass Fibers Inc., 1810 Madison Avenue, Toledo 2, Ohio.

Vitron® GLASS FIBER PRODUCT

Sales Offices and Distributors in Principal Cities

GLASS FIBERS INC.

Makers of glass fibers by the ELECTRONIC-EXTRUSION process . . . developed, patented and used exclusively by Glass Fibers Inc.

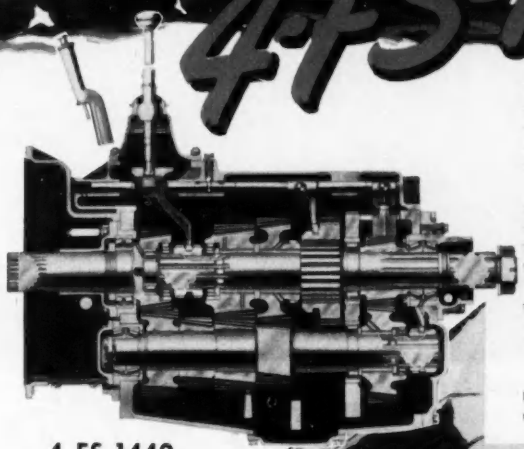
Now—Get the Advantages of Torque Converters on Your Biggest Trucks—with

The New Fuller 4-FS-1440

In keeping with its tradition of setting the pace with "The Best for the Biggest," Fuller announces its new 4-FS-1440 Transmission with closely spaced ratios for use with truck-type torque converters. This new unit makes new load-and-road performance possible in heavy duty service.

Built to deliver the power from the biggest automotive diesel engines now available plus ample capacity for high torque multiplication from the most advanced torque converters, the new 4-FS-1440 puts up to 400 hp. to work efficiently and dependably.

For maximum service plus maximum versatility in the toughest of heavy hauling, investigate the new 4-FS-1440. Write for performance and application data.



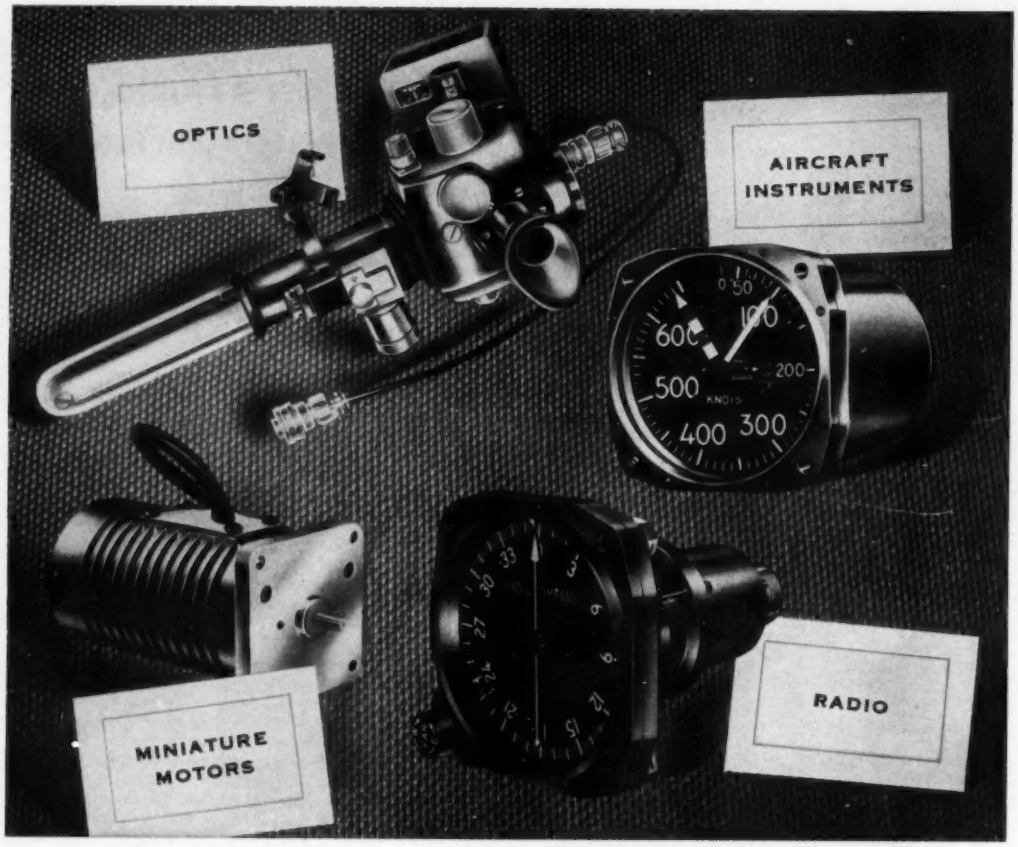
4-FS-1440

VITAL STATISTICS

Hp. handled—400. Speeds forward, 4: first, 1.98; second, 1.40; third, 1.00; fourth, .71. Reverse, 1.61. Weight 775 pounds.

FULLER MANUFACTURING COMPANY (Transmission Division), KALAMAZOO 13F, MICHIGAN

Unit Drop Forge Division, Milwaukee 1, Wis. • WESTERN DISTRICT OFFICE (SALES & SERVICE—BOTH DIVISIONS), 1060 E. 11th Street, Oakland 6, Calif.



At KOLLSMAN— *Versatility*

Twenty-three years back, the Kollsman Instrument Corporation took its first forward steps by devising a sensitive altimeter *twenty times* more responsive than preceding models. This instrument actually made possible the first completely blind flight in the history of aviation.

Today, this venturesome spirit continues to spark the design, development and manufacture of products of precision and dependability in the four distinct yet allied fields of:

Aircraft Instruments and Controls • • Miniature AC Motors for Indicating and Remote Control Applications • • Optical Parts and Optical Devices • • Radio Communications and Navigation Equipment

While current production is largely devoted to National Defense, the research facilities of the Kollsman Instrument Corporation remain available to scientists working toward the solution of instrumentation and control problems.

KOLLSMAN INSTRUMENT CORPORATION

ELMHURST, NEW YORK — GLENDALE, CALIFORNIA

Standard SUBSIDIARY OF COIL PRODUCTS CO. INC.

DEE-GEE

trademark of stability

SPECIALIZED SERVICES

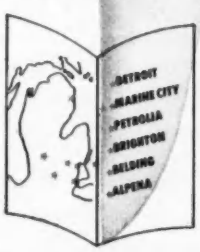
gaskets
Automotive, chemical, diesel, electrical, radio, refrigeration and many others

fabricated parts
Dashboard panels and insulators, sound deadeners, interleaf spring liners, glove compartments, sun visors

glazing tapes
cork and rubber—all rubber types

extruded metals
Aluminum shapes, free cutting brass rods, forging brass rods, brass shapes. Products fabricated from extrusions

packaging
Overhaul kits for overseas service to military specifications



More than a quarter century of service to America's largest manufacturers has proved the strength and stability behind the Dee-Gee trademark.

Large-scale production facilities, in seven modern plants, serve industry in many ways. We welcome the opportunity to discuss your requirements.

SERVING ORIGINAL EQUIPMENT MANUFACTURERS

DETROIT GASKET & MANUFACTURING COMPANY
DETROIT 23, MICHIGAN

Friction material problem?

R/M BELONGS IN YOUR PICTURE!

"STOP-AND-GO" IS OUR BUSINESS!

Passenger car manufacturers have long brought their brake and clutch problems to RAYBESTOS-MANHATTAN. They *know* they can count on R/M for brake linings, clutch facings, and automotive transmission friction parts for all cars of current or future design.

R/M leadership in the automotive industry is as old as the industry itself. More cars, trucks and buses use R/M friction materials than any other make.

And R/M leadership in these products takes in many other fields, from machine tools to farming equipment.

This wide variety of applications means that R/M experience can help *you* in practically any STOP-AND-GO problem. Call in your R/M representative. He can work from samples, from designs on paper, or from figures on horsepower development combined with desired performance characteristics. Behind him stand the facilities of the world's largest producers of friction materials, with six great plants . . . their research departments, and their testing laboratories.

The opening of our new Wabash Division, Crawfordsville, Ind., provides expanded facilities for the manufacture of
SINTERED METAL FRICTION MATERIALS

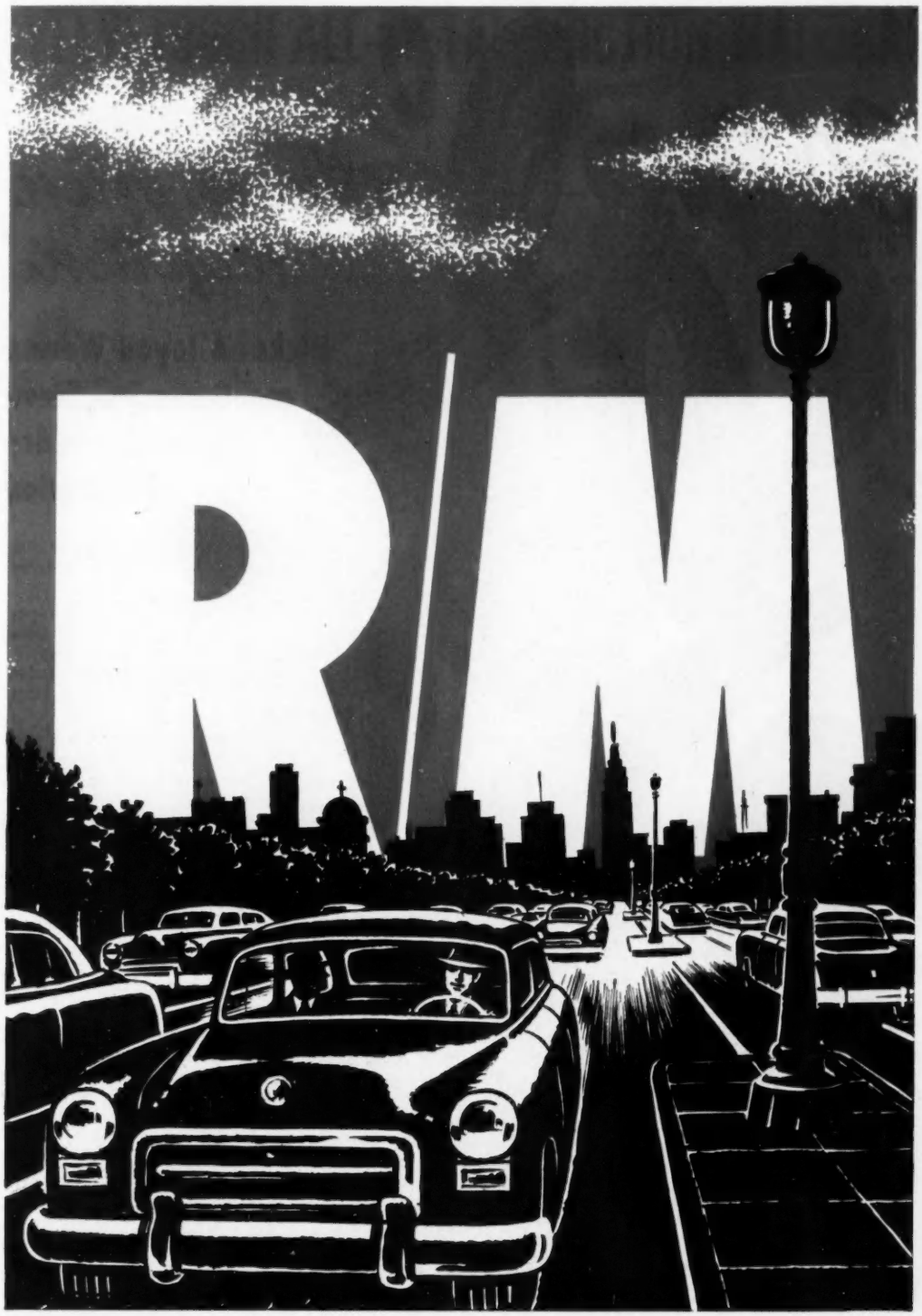
R/M
FIRST IN FRICTION

RAYBESTOS-MANHATTAN, INC.

EQUIPMENT SALES DIVISION 445 Lake Shore Drive, Chicago 11, Ill.
Detroit 2 Cleveland 14 Los Angeles 11

Factories: Bridgeport, Conn. Manheim, Pa. Passaic, N.J. No. Charleston, S.C.
Crawfordsville, Ind. Canadian Raybestos Co. Ltd., Peterborough, Ont.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Brake Linings • Brake Blocks • Clutch Facings Fan Belts • Radiator Hose • Industrial Rubber Products • Rubber Covered Equipment • Mechanical Packings • Asbestos Textiles • Sintered Metal Products • Abrasive and Diamond Wheels • Bowling Balls


R/M

So Good → they're often forgotten

Nickel Alloyed Worms and Gears Still Serve after 30 Years of Operation

A nickel bronze gear, teamed with a nickel alloy steel worm, gives you gearing that actually improves with use.

Many years ago, after considerable laboratory and actual field tests of various compositions, The Cleveland Worm and Gear Company . . . specializing for the past 40 years in the production of speed reducers . . . standardized on nickel-tin bronze gears.

Today, many of their drive units which were produced in the early days, are still operating regularly with the original worms and gears . . . which means more than 30 years of useful service.

The reason for this long, trouble-free performance is not hard to find. For nickel improves the strength of standard bronzes and is particularly effective in raising elastic properties . . . increasing shock resistance as much as 25 to 50 percent.

Nickel-containing alloys may meet the exacting demands of your particular equipment or production problems. Write us, today, for counsel and data.

At the present time, the bulk of the nickel produced is being diverted to defense. Through application to the appropriate authorities, nickel is obtainable for the production of nickel alloyed bronzes for many end uses in defense and defense supporting industries.

NICKEL-TIN BRONZE . . . containing approximately 1½% nickel, 10½% tin, a maximum of 0.25% lead, the balance copper . . . is produced by several foundries for gear requirements of The Cleveland Worm and Gear Company of Cleveland 4, Ohio.

This company also uses Type 2317 (3½% nickel) carburizing steel for worms of large size, and Type 4615 (nickel-molybdenum) carburizing steel for the smaller sizes. Both of these steels are especially easy to handle in heat treatment, and consistently provide the hard surface and tough core so essential to efficient, long-lasting operation. Moreover, they withstand reasonably rapid grinding on automatic thread grinders without surface cracking or spalling.

EMBLEM OF INCO SERVICE
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

VELVETOUCH ALL-METAL FRICTION MATERIAL

Engineered
TO MEET YOUR
SPECIFIC NEEDS

Whatever your requirements might be . . . for a plate, disc, cone or band type friction product . . . we can meet your needs with a material developed for your specific requirements. Unlike asbestos, Velvetouch is made from powdered metals . . . and the formula can be altered to give you the exact operating characteristic you want! In addition, being all-metal, Velvetouch lasts longer . . . won't glaze like asbestos . . . requires fewer adjustments . . . delivers a more uniform friction action. Our engineers will be glad to work with you. Either contact our nearest branch . . . or write The S. K. Wellman Company, 1374 East 51st Street, Cleveland 3, Ohio.

Velvetouch

THE S. K. WELLMAN CO. WAREHOUSING CENTERS

ATLANTA—110 14th St., N. E. Atlanta 5, Georgia

CHICAGO—1500 South Western Ave., Chicago 8, Illinois

CLEVELAND—1392 East 51st St., Cleveland 3, Ohio

DALLAS—3407 Main Street, Dallas 1, Texas

LOS ANGELES—1110 S. Hope Street, Los Angeles 15, Calif.

PHILADELPHIA—1845 West Belfield Ave., Philadelphia, Pa.

PORTLAND—638 N. W. 10th Ave., Portland 9, Oregon

SAN FRANCISCO—424 Bryant Street, San Francisco 7, Calif.

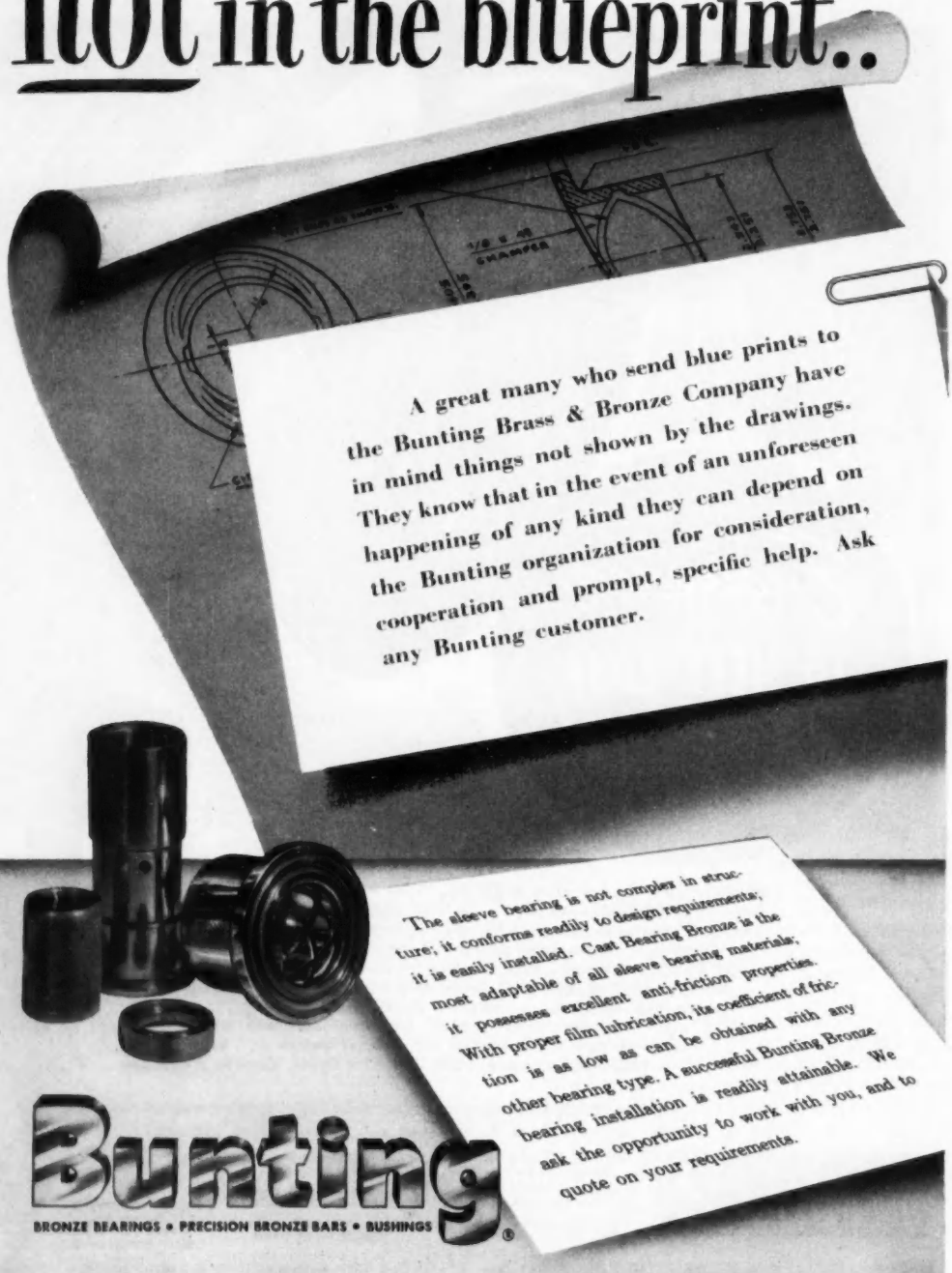
TORONTO, ONTARIO
The S. K. Wellman Co. of Canada, Ltd., 2838 Dufferin St.

• • •

EXPORT DEPARTMENT—
8 So. Michigan Ave.
Chicago 3, Ill., U. S. A.

WASHINGTON OFFICE—
1101 Vermont Ave., N. W.
Washington 5, D. C.

not in the blueprint..



A great many who send blue prints to the Bunting Brass & Bronze Company have in mind things not shown by the drawings. They know that in the event of an unforeseen happening of any kind they can depend on the Bunting organization for consideration, cooperation and prompt, specific help. Ask any Bunting customer.

The sleeve bearing is not complex in structure; it conforms readily to design requirements; it is easily installed. Cast Bearing Bronze is the most adaptable of all sleeve bearing materials; it possesses excellent anti-friction properties. With proper film lubrication, its coefficient of friction is as low as can be obtained with any other bearing type. A successful Bunting Bronze bearing installation is readily attainable. We ask the opportunity to work with you, and to quote on your requirements.

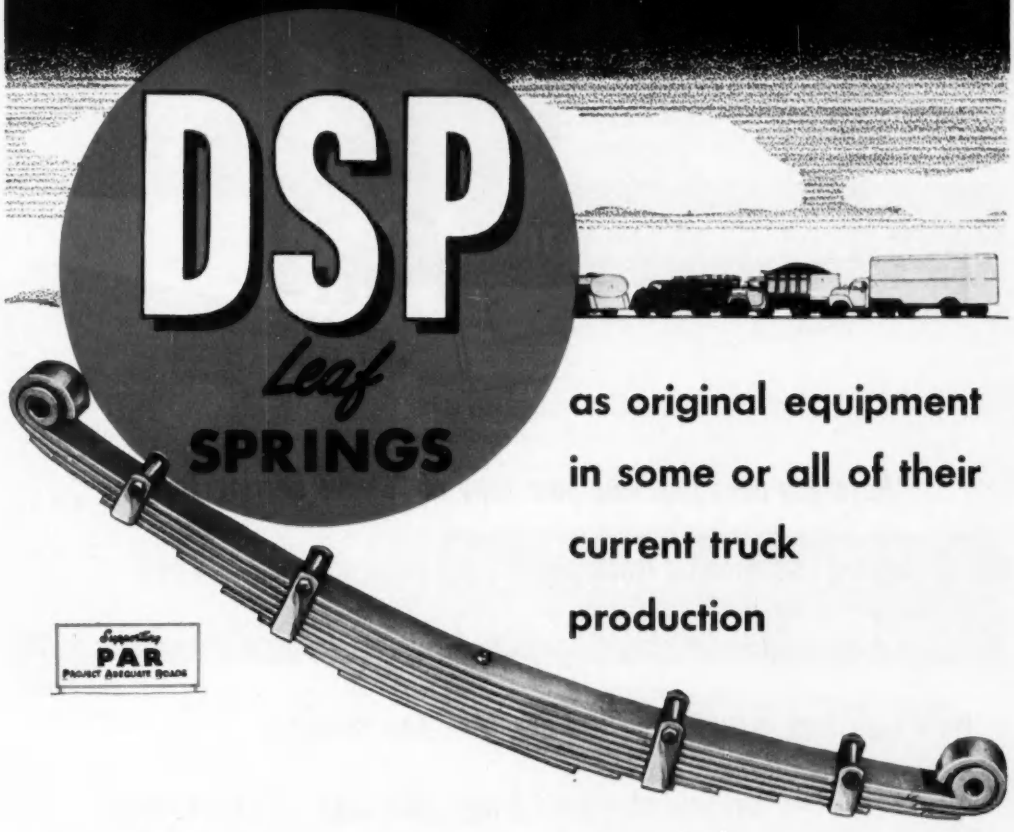
Bunting®

BRONZE BEARINGS • PRECISION BRONZE BARS • BUSHINGS

THE BUNTING BRASS & BRONZE COMPANY • TOLEDO 1, OHIO • BRANCHES IN PRINCIPAL CITIES

FIND OUT WHY THE MAKERS OF MOST OF AMERICA'S HEAVY TRUCKS USE

DSP Leaf SPRINGS



as original equipment in some or all of their current truck production

Supporting PAR Project Adequate Roads

If you make trucks, buses, trailers, or other heavy vehicles, DSP offers you *all* these advantages: SPECIALIZED EXPERIENCE that goes back to 1904—making leaf springs as original equipment for the automotive industry.

SPECIALIZED EQUIPMENT—to turn out dependable heavy leaf suspension springs. DSP has produced many millions of springs over a period of years, under exacting quality and metallurgical controls.

SPECIALIZED ENGINEERING AND RESEARCH—concentrated on *heavy leaf suspension spring* designs to carry specific loads and meet the most severe operating conditions.

The DSP plant is in Detroit, accessible to the main centers of truck production.

Automotive Division

DETROIT STEEL PRODUCTS COMPANY

Also Makers of Fenestra Building Products

2250 E. Grand Blvd., Detroit 11, Michigan

SINCE 1904 — ORIGINAL EQUIPMENT ON CARS, TRUCKS, CABS, BUSES, TRAILERS

FREE—
to designers,
engineers,
draftsmen

Have you been receiving your copy of "Sleeve Bearing Topics" . . . the convenient reference on materials, designs, new developments and applications of sleeve bearings, bushings and similar precision parts. We'll send back issues while still available. Your business letterhead request brings your copy . . . write today.

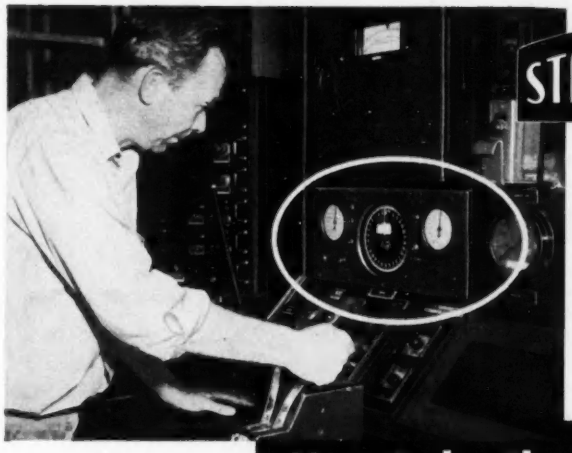
FEDERAL-MOGUL CORPORATION, 11035 SHOEMAKER, DETROIT 13, MICHIGAN

FEDERAL-MOGUL

SINCE 1899

FEDERAL Mogul

Products of our six plants include: Sleeve bearings in all designs and sizes; cast bronze bushings; rolled split-type bushings; bi-metal rolled bushings; washers; spacer tubes; precision bronze parts and bronze bars.



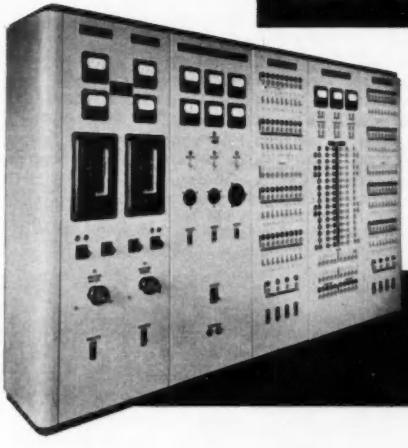
STANDARD

SINCE 1884

WRIGHT AERONAUTICAL DIVISION
CURTISS-WRIGHT CORPORATION

This photograph, taken in one of the experimental cells of the Wright Aeronautical plant at Woodridge, N. J., shows a STANDARD Chronotachometer installed in their test panel.

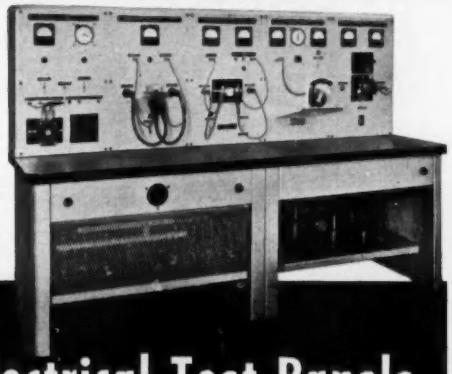
Not Only Chronotachometers . . .



WILSON DAM (T. V. A.)

This experimental control and distribution switchboard handles various power supplies for their Chemical Laboratory Building.

plus "flexlab" Control and Distribution Switchboards



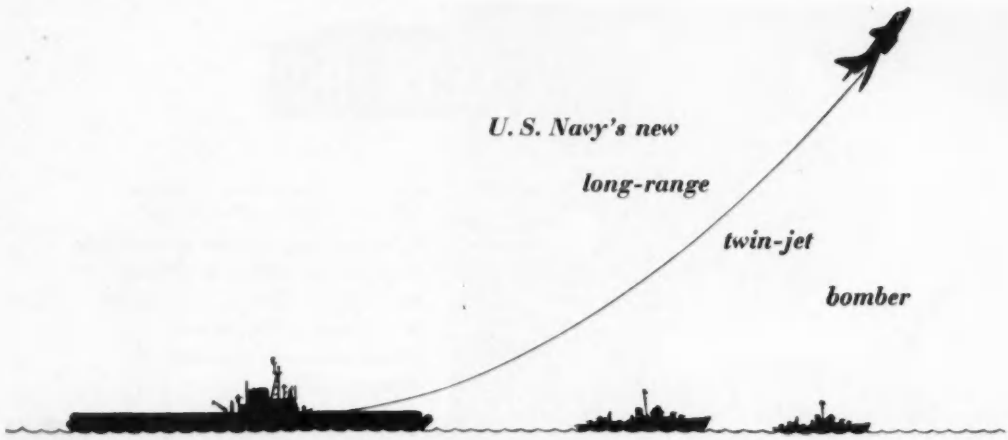
WESTINGHOUSE ELECTRIC COMPANY

This specially designed unit is for the control and test of aircraft timers, series relays, contactors, servo motors, and booster coils. It is typical of the wide range of custom-built equipment by STANDARD.

. . . but all kinds of Custom-built Electrical Test Panels

THE STANDARD ELECTRIC TIME COMPANY

87 LOGAN STREET · SPRINGFIELD 2, MASSACHUSETTS



____the Douglas A3D

Built for the Navy, and now undergoing tests, the carrier-based Douglas A3D is designed to add new striking power to the Naval air arm.

Performance data on this plane is still secret, but no aircraft of comparable size —now in service or contemplated for early service introduction—will be able to carry an equivalent bomb load as high or as fast as the Douglas A3D. Powered by twin jets, slung in pods below the wing outboard of the fuselage, A3D will be in the 600 to 700 mph class . . . yet its planned range, from aircraft carriers, will let it strike across wide expanses of water at enemy targets.

Selection of Douglas to build the A3D is another example of this company's aviation leadership. *Faster and further with a bigger payload* is the basic concept of Douglas design.

Depend on *DOUGLAS* **First in Aviation**

THE NEW YORK AIR BRAKE COMPANY

A DIGEST OF NEW DEVELOPMENTS IN HIGH PERFORMANCE PUMPS

PAGE

- PISTON TYPE FLUID POWER PUMPS

  Featuring continuous working pressures to 3000 psi and continuous speeds to 3750 rpm, today's STRATOPOWER oil hydraulic Pumps (both constant and variable delivery types), afford special advantages for aircraft and other applications. The dual pressure Pumps incorporate remote oil pilot controlled pressure regulator. An electric modification provides selective pressure control and Pump unloading. These Pumps are self-priming and develop suction line pressures approaching 1" Hg. absolute and will also operate under conditions of high reservoir pressurization. 2

- VANE TYPE FLUID POWER PUMPS

  A distinctive Dual Vane construction, which provides increased fluid delivery rates (even with extremely thin fluids), makes DUDCO Hydraulic Pumps and Motors the first single-stage vane type proven for 2000 psi operation. The minimum size and high efficiencies of these Pumps and Motors create new opportunities in the design of hydraulic fluid power systems for all types of industrial equipment as well as countless applications on heavy-duty machinery and ordnance vehicles. 2

- GEAR TYPE FLUID POWER PUMPS

  A unique Four-Bolt design, which locates the assembly bolts within the area of greatest internal pump pressure, indorses HYDRECO Hydraulic Pumps for the heavy-duty required in equipment for the construction and materials handling fields. This Four-Bolt design provides the rigidity and stability that reduces distortion of housing parts and wear plates and insures against uneven wear and loss of overall efficiency in the face of extreme mechanical and hydraulic loads. 3

- ROTARY LIQUID HANDLING PUMPS

  Virtually any material that will flow through a pipe, including difficult viscous fluid,can be handled with meter-like volumetric accuracy with today's KINNEY Rotary Plunger and Wide Angle Herringbone Gear Pumps. The Rotary Plunger Pump features a construction with no valves, blades, pistons or springs. The versatile line of Herringbone Gear Pumps includes models driven by timing gears with anti-friction bearings located outside the pump chamber. Both types available with or without heating jackets. 3

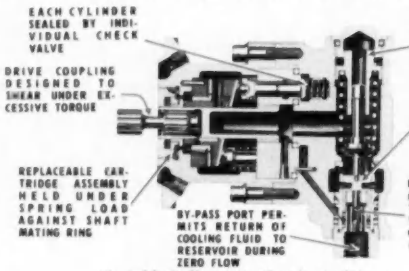
- HIGH VACUUM PUMPS

  There is only one principle which has been found suitable for Vacuum Pumps in all capacity ranges...that of the Rotary Plunger employed in KINNEY High Vacuum Pumps. First to use the oil-sealed Rotary Plunger, these Pumps develop absolute pressure readings of 0.1 Micron (0.0001 mm Hg.) or better. Alone or in combination with oil diffusion Pumps, they provide the answer to the most exacting high vacuum applications in the electronic, processing and research fields. 4

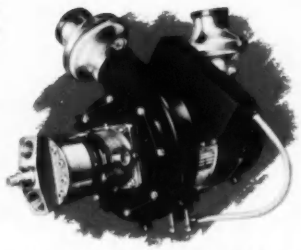
The New York Air Brake Company and its affiliates provide a most comprehensive coverage of Pumps and related equipment for the needs of defense and industry. Here, in one organization, is "Know How" teamed with advanced facilities and a tradition of precision and craftsmanship. Here is research and development dedicated to the constant improvement and the ever-broadening service which hydraulic and vacuum equipment can contribute now and in the Future.

PISTON TYPE FLUID POWER PUMPS

Constant Delivery Type


EACH CYLINDER SEALED BY INDIVIDUAL CHECK VALVE
DRIVE COUPLING DESIGNED TO SHEAR UNDER EXCESSIVE TORQUE
REPLACEABLE CARTRIDGE ASSEMBLY HELD UNDER SPRING LOAD AGAINST SHAFT MATING RING
BY-PASS PORT PERMITS RETURN OF COOLING FLUID TO RESERVOIR DURING ZERO FLOW
VALVE SPRING ADJUSTING NUT VARIES DISCHARGE PRESSURE TO DESIRED LIMITS
VALVE PISTON CONTROLS FLOW TO INTAKE CHAMBER
PILOT PISTON MOVES VALVE PISTON AGAINST VALVE SPRING TO CONTROL INTAKE FLOW

Variable Delivery Suction Control Type



Variable Delivery Motorized Unit

APPLICATIONS

Raising and lowering Landing Gear, Bomb Bay Doors, etc.

Controlling Elevators, Ailerons, Wing Flaps, Stabilizers, Rudders.

Hydraulic power for steering Guided Missiles.

Wing folding on Navy-type Aircraft.

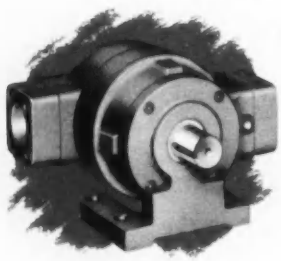
Actuating boom for In-Air Refueling.

Power for Nose Wheel Steering and applying Aircraft Brakes.

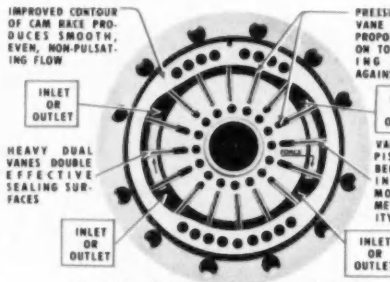
To appreciate the broad selection available in STRATOPOWER Hydraulic Pumps, there are 85 distinct models ranging in capacity from 0.25 gpm to 10 gpm at 1500 rpm. With variations in capacities, port sizes, mounting pads, etc., this Line represents a most comprehensive coverage of pumps for high pressure hydraulic systems. Both direct engine driven and electric motorized units are furnished in constant and variable delivery types for continuous working pressures to 3000 psi and continuous speeds to 3750 rpm (maximum 4500 rpm for intermittent duty).

These Pumps are of the axial reciprocating type with rotating cam and fixed cylinders — from five to nine pistons are used, depending upon the size and type of pump. Aviation, with its special requirements in size, capacities, operating pressures, service altitudes and low temperature performance, represents the principal demand today for STRATOPOWER Pumps. However, the higher pressures and unique characteristics of these Pumps recommend them for industrial applications without number.

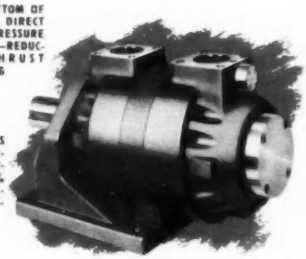
VANE TYPE FLUID POWER PUMPS



Medium Series


IMPROVED CONTOUR OF CAM RACE PRODUCES SMOOTH, EVEN, NON-PULSATING FLOW
INLET OR OUTLET
HEAVY DUAL VANES DOUBLE EFFECTIVE SEALING SURFACES
INLET OR OUTLET
PRESSURE ON BOTTOM OF VANE VARIES IN DIRECT PROPORTION TO PRESSURE ON TOP OF VANE—REDUCING VANE THRUST AGAINST CAM RING
INLET OR OUTLET
VANES ACT AS PISTON MEMBERS PROVIDING 15-20% MORE VOLUMETRIC CAPACITY
INLET OR OUTLET

Diametrically Opposed Inlet and Outlet Ports Balance Loads on Shaft and Rotor



Large Series

APPLICATIONS

Explosion-proof Drives for Traction Wheels of Conveyers; Cutting Heads of Mining Machinery.

Power Source and Control for Hydraulic Presses and Die Casting Machines.

Traverse and Feed Control of Work Tables, Cutting Tools, etc. on Machine Tools.

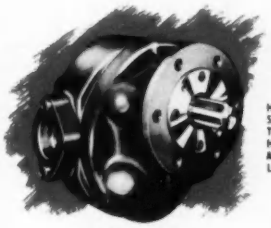
Controlled Rotation for Centrifuges, Mixers, Agitators, etc.

Winch Drives for Marine, Construction, Ordnance and Oil Field Equipment.

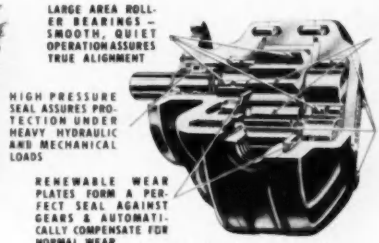
The patented DUAL-VANE feature of DUDCO Hydraulic Pumps and Motors represents today's most forward step in industrial hydraulics. The Vanes bear radially outward with positive forces, which, while adequate for pressure sealing, are balanced hydraulically to eliminate "wear producing" thrust against the cam ring.

Dependable operation at pressures of 2000 psi with efficiencies well over 90% encourage the application of hydraulic circuits using smaller valves, piping and cylinders for given HP requirements. Frequently DUDCO Pumps can more than double the tonnage output of many existing circuits without changing the standard parts in the system. DUDCO Vane Type Pumps are furnished in capacities from 3 gpm to 120 gpm. Standard models are rated at 1200 rpm and specials are available to 3600 rpm. Both pipe and flange connected ports are standard, with several models available for sub-plate mounting on either one or all of the ports. Multiple units, developing two volumes from a single shaft drive are also available.

GEAR TYPE FLUID POWER PUMPS



Medium Series


LARGE AREA ROLLER BEARINGS – SMOOTH, QUIET OPERATION ASSURES TRUE ALIGNMENT
HIGH PRESSURE SEAL ASSURES PROTECTION UNDER HEAVY HYDRAULIC AND MECHANICAL LOADS
RENEWABLE WEAR PLATES FORM A PERFECT SEAL AGAINST GEARS & AUTOMATICALLY COMPENSATE FOR NORMAL WEAR
PRECISION SPUR GEARS PROVIDE HIGH VOLUMETRIC EFFICIENCY AND LONG SERVICE LIFE
FOUR-BOLT MOUNTING LOCATED IN AREA OF GREATEST INTERNAL PRESSURE... ELIMINATES DISTORTION, PROVIDES ALIGNMENT

Typical 4-Bolt Construction

Tandem Type

APPLICATIONS

Hoisting and Tilting of Load Platform on Industrial Lift Trucks . . . Hydraulic drives for traction wheels.

Operating Industrial Type Elevator Lifts.

Driving and Positioning Belt and Screw Conveyors.

Raising Dump Bodies on Trucks — Moving Blades, Scrapers, Buckets, Plows, etc., on Bulldozers and other Construction Machinery.

Power Steering on Road Rollers — Power Brakes for Heavy-Duty Vehicles. Remote control of Farm Equipment attached to Tractors.

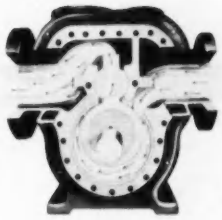
HYDRECO Oil Hydraulic Gear Pumps are specifically designed and produced for original equipment and are widely favored among engineers in the materials handling, construction and earth moving machinery fields. The basic designs lend themselves to volume production and the natural advantages of construction with standard component parts. Special mountings and other modifications are provided to suit specific applications. The rugged, yet supremely simple Four-Bolt construction is available through a range of capacities from ½ gpm to 130 gpm for working pressures to 1500 psi and operating speeds to 2000 rpm. They are also available in multiple units wherein two pumps operate from a single shaft or power source.

HYDRECO Pumps operate at high efficiency with a minimum of maintenance and render long service life even where the "going is tough." This dependability points up the importance of the Four-Bolt design and the many features of engineering and precision that are so evident in HYDRECO Pumps.

LIQUID HANDLING PUMPS

Heliquad Type

Medium Series Rotary Plunger



Rotary Plunger Type

APPLICATIONS

Moving Tar, Asphalt, Road Oil and Bunker Fuel at High Temperatures.

Cargo Oil Pump Service; Storage, Tank Truck and Freight Car Service; Fuel Oil Booster Service.

Pumping Molasses and Syrups in Sugar and Allied Industries.

Moving White Lead, Heavy Greases and Caustic Soda in Chemical Process Industry.

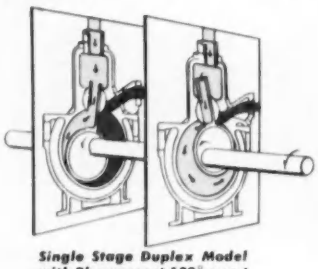
Pumping Sea Water for Ship's Ballast and Diesel Engine Cooling.

Steady, non-pulsating flow of liquids from asphalt to alcohol . . . the ability to efficiently and economically move "any liquid that will flow through a pipe" . . . that in a nutshell describes today's KINNEY Liquid Handling Pumps. Their outstanding performance is the one big reason they have received unqualified acceptance throughout the Petroleum, Marine, Processing, Construction and other industries.

KINNEY Pumps, whether of the Heliquad or Rotating Plunger Type render positive displacement, even with the more difficult liquids and operate with high efficiency over a broad range of temperatures up to 750°F. They are available in plain or steam jacketed models in capacities from 2 gpm to 3360 gpm and at pressures to 250 psi.

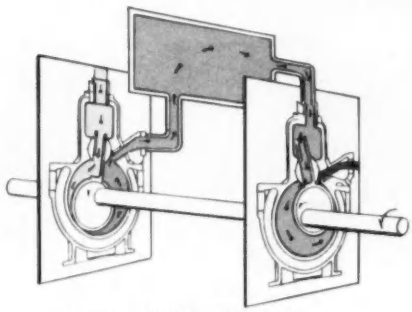
A recent survey of KINNEY Pumps in service for over nine years showed an average cost for repairs of less than 2% of the original cost per year of service.

HIGH VACUUM PUMPS



Single Stage Duplex Model with Plungers set 180° apart

Small Capacity Compound Vacuum Pump



Compound Model with Plungers in Series Connected to Oil Chamber between Stages

APPLICATIONS

Vacuum Systems for production of Electric Light Bulbs, Television and Electronic Tubes.

●

Freeze Drying in Pharmaceutical Research and Production of Essences, and various "mycin" Drugs.

●

High Vacuum Evaporation of Metals and Metallic Salts . . . Refining and Recovery of Precious Metals.

●

Vacuum Distillation, Food Processing, Food Preservation, Packaging, etc.

●

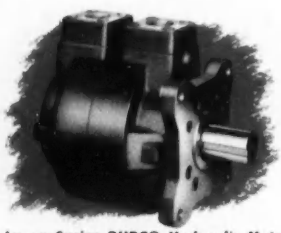
Production of High Alloy Steels and Commercial Metals by Inert Atmosphere Process.

●

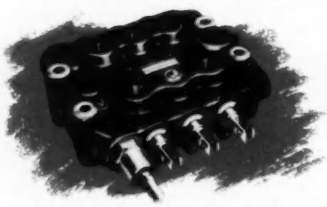
In the comparatively short time that high vacuum processing has advanced from laboratory to production line, industry has found the KINNEY Rotating Plunger principle preeminent in performance, efficiency and all-around dependability. High-pumping speeds, economical use of power and extremely low ultimate pressures signalize their performance.

KINNEY High Vacuum Pumps range from the big 75 HP unit with 1800 cu. ft. per min. displacement down to the ¼ HP Pump rated at 2 cu. ft. per min. . . . with standard models for laboratory, pilot plant or production line. Two basic pump types are available — Single Stage and Compound — to 10 microns and 0.1 microns respectively. A selection of outlet valves permits the choice of the efficient feather valve for extremely low pressures . . . or, the exclusive-type poppet valve in corrosion-resistant materials for air-vapor mixtures.

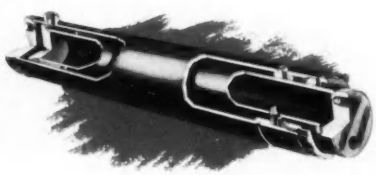
MOTORS, VALVES & CYLINDERS



Large Series DUDCO Hydraulic Motor



HYDRECO Multiple Plunger Selector Valve with Integral Check and Pressure Control



HYDRECO Telescoping Cylinder

In addition to the complete range of Pumps described, there are equally important components. . . . Hydraulic Motors, Valves and Cylinders . . . all available from a single source. DUDCO Hydraulic Motors, employing the remarkably efficient DUAL-VANE principle, with high running torques averaging 90% or more of theoretical at any speed down to nearly stalled and with smooth operation under load. Models rated from 9 to 720 in. lbs./100 psi for 2000 psi operation. HYDRECO Hollow Plunger Valves in single or multiple plunger units for controlling single, double-acting or telescopic HYDRECO Cylinders as well as other Hydraulic Power Units . . . capacities from ½ gpm to 150 gpm and for operating pressures to 1500 psi. Relief Valves, Pressure Regulators, Flow Dividers and other special purpose Valves are available for nearly any type of Hydraulic circuit.

Catalogs and complete information on the Hydraulic Pumps, Motors and other components herein described are available on request.

THE NEW YORK AIR BRAKE COMPANY

420 LEXINGTON AVE., NEW YORK 17

AFFILIATES: DUDCO DIVISION • • • HYDRECO DIVISION • • • KINNEY MANUFACTURING CO.

THE BENDIX IGNITION ANALYZER GIVES ADVANCE WARNING OF SPARK PLUG FAILURE

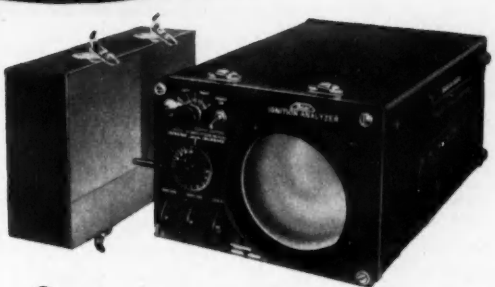
Result: ADDED SAFETY

THE POINT OF NO RETURN BECOMES A POINT OF ASSURANCE

The Bendix Ignition Analyzer actually *foresees the future* by predicting the remaining life of spark plugs. With the Ignition Voltage Control the operator can determine the present efficiency of all spark plugs and put the finger on any weakness in the system—even though it has not yet affected the operation. If the control reveals impending trouble, corrective action may be taken *before* material harm takes place. With an airborne installation of the Ignition Analyzer, the test can be made before an over-water flight reaches the point of no return. By viewing the wave forms on the face of the 'scope and comparing with known patterns, the operator can quickly make the *right* choice . . . to return without mishap, to operate at reduced power and prevent complete engine failure or to continue safely at cruising speed.

So, for maximum safety and operating efficiency it pays to make provisions for installation of a Bendix Ignition Analyzer on all your aircraft.

Detailed information available on request.



Costs Less—Does More

The Bendix Ignition Analyzer is available for either airborne or portable-airborne installations. It can be used with either high or low tension magneto or battery ignition. It is the ignition analyzer that can predict spark plug failure before it occurs . . . make an efficient check of more than one spark plug at a time and do so on a large, easy to read screen . . . yet it costs less than comparable analyzers.

Bendix

SCINTILLA MAGNETO DIVISION OF SIDNEY, NEW YORK

Bendix AVIATION CORPORATION

Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N. Y.

FACTORY BRANCH OFFICES: 117 E. Providencia Avenue, Burbank, California • Stephenson Building, 6560 Cass Avenue, Detroit 2, Michigan
Brouwer Building, 176 W. Wisconsin Avenue, Milwaukee, Wisconsin • 582 Market Street, San Francisco 4, California

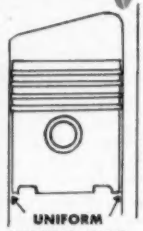
SENSATIONAL NEW PISTON BY ZOLLNER

CLEAR◯MATIC*

*T. M. Reg. Pat. App. for

STEEL TENSION MEMBER
anchored only at pin bosses
and cast in positive contact
with I. D. of piston skirt
Controls Clearance Automatically

Engine Builders, everywhere are heralding the newest accomplishment of Zollner engineers. Now pistons can be *fitted to less than .001 clearance with positive uniformity of skirt bearing under all temperatures.* The steel tension member incorporates in the aluminum piston the same effective expansion as the ferrous cylinder itself. The amazing new CLEAROMATIC Piston results in a *quiet engine, with no cold slap, reduced friction, without any sacrifice of durability or heat conductivity.* We suggest an immediate test of these advantages for your engine, now. CLEAROMATIC Pistons bring the advanced engine performance of tomorrow here today!



UNIFORM EFFECTIVE SKIRT CLEARANCE AT ALL TEMPERATURES

Design adaptable to full skirted or slipper type pistons for gasoline engines for every purpose.

1. Clearance maintained uniformly at all coolant temperatures from 20° below zero to 200° F.
2. Effective expansion identical with ferrous cylinder.
3. Steel tension member, with same effective expansion as cylinder, maintains uniform skirt clearance through entire temperature range.
4. Normal diametral clearance usually less than .001 with uniform skirt bearing.
5. Durability and conductivity comparable to heavy duty design.

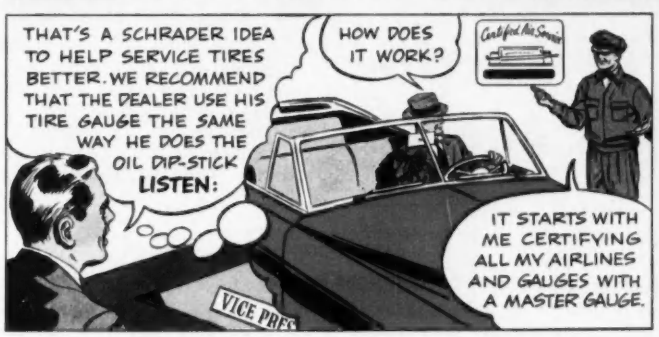
ZOLLNER

- **ADVANCED ENGINEERING**
- **PRECISION PRODUCTION in Cooperation with Engine Builders**

The Original Equipment **PISTONS**

ZOLLNER MACHINE WORKS • FORT WAYNE, IND.

Schrader Contributions to the Tire Industry


THAT'S A SCHRADER IDEA TO HELP SERVICE TIRES BETTER. WE RECOMMEND THAT THE DEALER USE HIS TIRE GAUGE THE SAME WAY HE DOES THE OIL DIP-STICK
LISTEN:
HOW DOES IT WORK?
Certified Air Service
IT STARTS WITH ME CERTIFYING ALL MY AIRLINES AND GAUGES WITH A MASTER GAUGE.
VICE PRES.

...I INFLATE TO RECOMMENDED PRESSURE APPLYING THE HEAT BUILD-UP FORMULA FOR SAFEST DRIVING, RIDING COMFORT AND STEERING EASE. THEN I SEAL IN THE AIR WITH THIS VALVE CAP.
IT SURE SOUNDS GOOD TO ME.
VICE PRESIDENT

And it sounds good to the many dealers who are now using Certified Air Service as part of their regular procedures . . . and it helps them service and sell tires. This is but one example of the service behind Schrader Tire Valve Equipment that extends right down to the car owner.

Have you seen a copy of the Certified Air Service procedure manual? Write for Manual C-200.

A. SCHRADER'S SON, 470 VANDERBILT AVE., BROOKLYN 17, N. Y.
Division of Scovill Manufacturing Company, Incorporated

Schrader
REG. U. S. PAT. OFF.

FIRST NAME IN TIRE VALVES
FOR ORIGINAL EQUIPMENT AND REPLACEMENT

In Selecting Spring Steel

It's the Size of Section that Governs the Analysis

The size of a spring section is the factor that often determines the grade of steel for a given spring application.

It is considered sound practice to use a grade whose alloy content is consistent with the thickness of the finished section. A steel of medium or low alloy content will generally be adequate for use in a thin spring section. Heavier springs, on the other hand, take steels of richer alloy content to quench out properly.

Although this principle may sound simple, it calls for a careful study of spring sizes, stresses, forming methods, and heat-treatment. In this connection we will be glad to help. Our metallurgists will give you unbiased advice based on their familiarity with all grades of spring steels.

When you are in the market for alloy steels, remember that Bethlehem manufactures all AISI grades as well as special steels.

SPRING WEIGHT	*ANALYSIS*
Light Spring Sections	**9255**
	5150
	4063
	TS 8160
Medium Spring Sections	**6150**
	8650
	9260
	TS 8650
Heavy Spring Sections	**9262**
	8655
	TS 8655

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

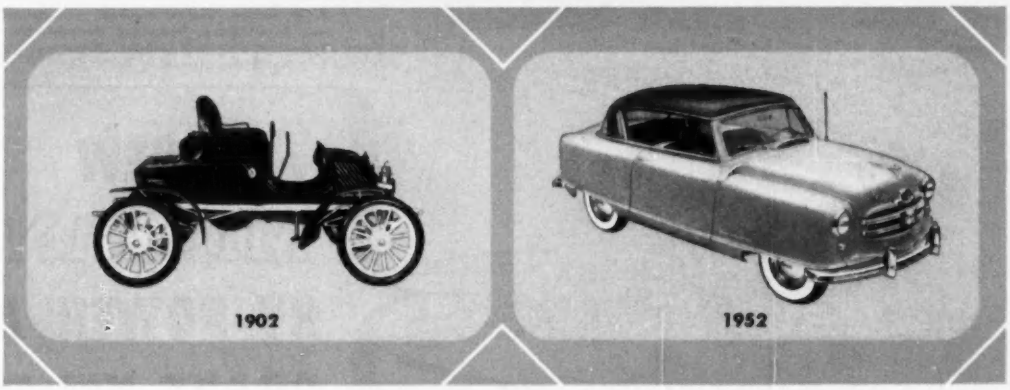
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM *ALLOY* STEELS

Congratulations

Nash



on 50 years of Golden Progress

The 1902 Rambler shown above was one of the world's first mass-produced cars. Today, the 1952 Nash Rambler, also illustrated above, is maintaining the tradition of a great name in automotive history. The three Nash Golden Airflytes—the Ambassador, Statesman and Rambler—are writing new success stories in sales, style, advanced engineering and performance.

In the fifty-year period between these models, Nash has produced more than 2,250,000 automobiles . . . pioneered scores of important developments. You can be certain that Nash will continue to build automobiles that set a pace and pattern for the cars of tomorrow.

We are proud of the part we have played in the Nash success story and look forward to the next 50 years of association with this fine company.

*REG. U. S. PAT. OFF.

Eclipse Machine

DIVISION OF Bendix AVIATION CORPORATION

ELMIRA, NEW YORK

Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N. Y.

Bendix* Pole-Thru Starter Drive Bendix* Automotive Electric Fuel Pump Stromberg* Aerocyclo Carburetor

Blair Transit Company
GENERAL OFFICES
124 DAVENPORT STREET
SAGINAW, MICHIGAN

REPLY TO: General Offices

Mr. Harold George
George Electric Company
Midland Power Brake Distributor
308 North Hamilton Street
Saginaw, Michigan

Dear Mr. George:

You asked what we thought of the Midland Air Power Brakes that you have been installing on our tractors.

Here is the answer in a few words. We like the system, particularly because of the Midland Compressor and Air HY-Power. The installation is simple and workmanlike. We have had no trouble since the first tractor was equipped. And, of course, the price angle was something that appealed to us.

In addition to the equipment that you have already installed and the other tractors for which we have ordered Air Brake Equipment, we are anticipating putting Midland Power Brakes on many more units.

It is our opinion that Air is the thing in motor transport braking.

Sincerely,
BLAIR TRANSIT COMPANY
A. W. Dunlap,
General Manager

A. W. Dunlap, General Manager, discusses equipment with A. B. Hickey, Operations Manager. Blair Transit Company's equipment includes 100 tractors, 25 pick-ups and over 200 trailers.

NEW MIDLAND HY-POWER AIR BRAKE KIT FOR CHEVROLET

ADOPTED BY

BLAIR TRANSIT CO.

LEADING motor transport operators throughout the world are supplementing the braking equipment of their fleets of trucks, tractors and buses with *proved* Midland Power Brakes. Billions of miles of operation under every traffic and road condition have proved Midland's dependability, long life and low-cost, trouble-free service.

THE MIDLAND STEEL PRODUCTS CO.
6660 MT. ELLIOT AVE. DETROIT 11, MICH.
Export Department: 38 Pearl St., New York, N. Y.

Those who know Power Brakes Choose Midland

SPECIAL INSTALLATION KITS FOR ALL POPULAR MAKES AND MODELS OF TRUCKS—SEE YOUR NEAREST MIDLAND DISTRIBUTOR

MIDLAND

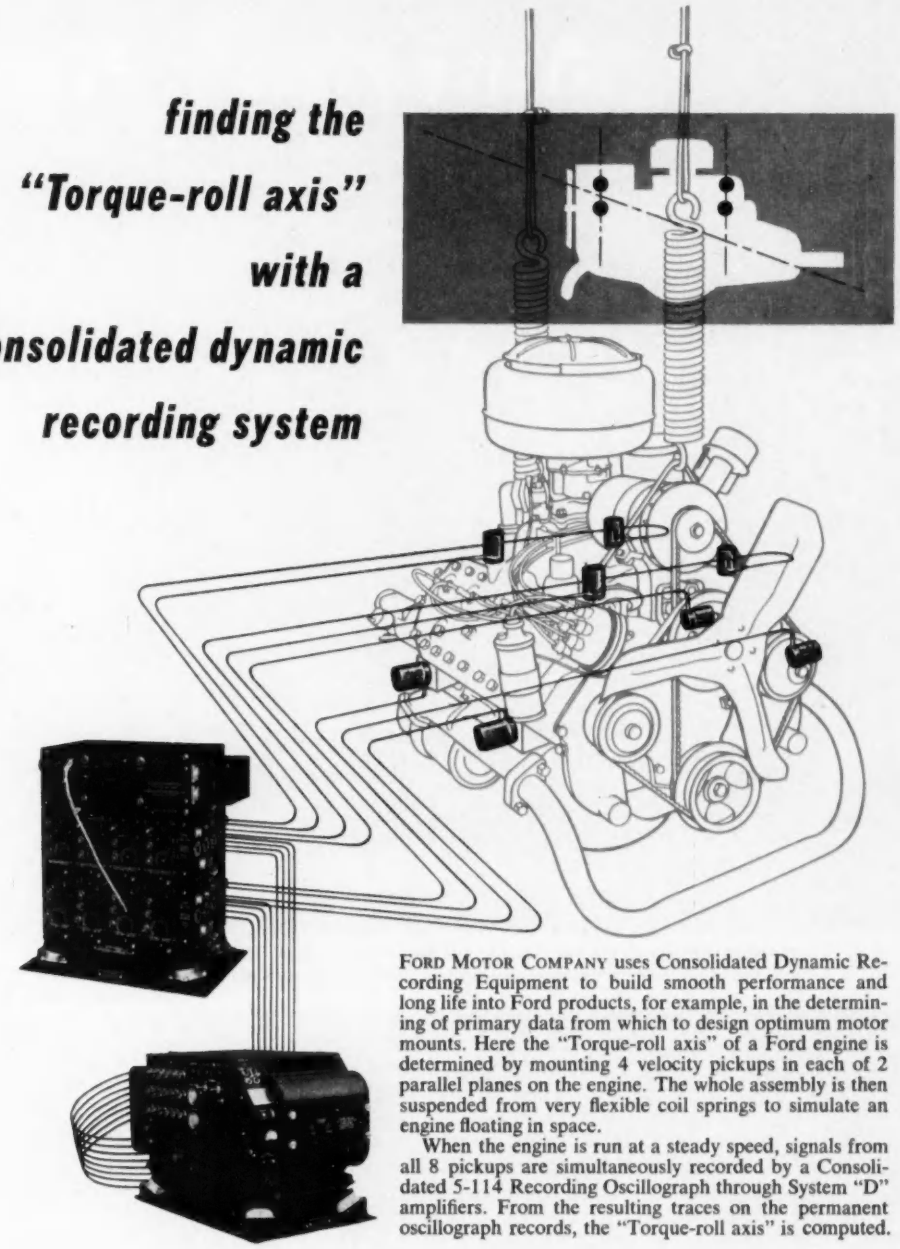
POWER BRAKE EQUIPMENT

AUTOMOBILE AND TRUCK FRAMES

BUS DOOR CONTROLS

250 Service Organizations
To Serve You
Wherever You Are

finding the "Torque-roll axis" with a Consolidated dynamic recording system



FORD MOTOR COMPANY uses Consolidated Dynamic Recording Equipment to build smooth performance and long life into Ford products, for example, in the determining of primary data from which to design optimum motor mounts. Here the "Torque-roll axis" of a Ford engine is determined by mounting 4 velocity pickups in each of 2 parallel planes on the engine. The whole assembly is then suspended from very flexible coil springs to simulate an engine floating in space.

When the engine is run at a steady speed, signals from all 8 pickups are simultaneously recorded by a Consolidated 5-114 Recording Oscillograph through System "D" amplifiers. From the resulting traces on the permanent oscillograph records, the "Torque-roll axis" is computed.

Consolidated Engineering
CORPORATION
300 North Sierra Madre Villa, Pasadena 15, California

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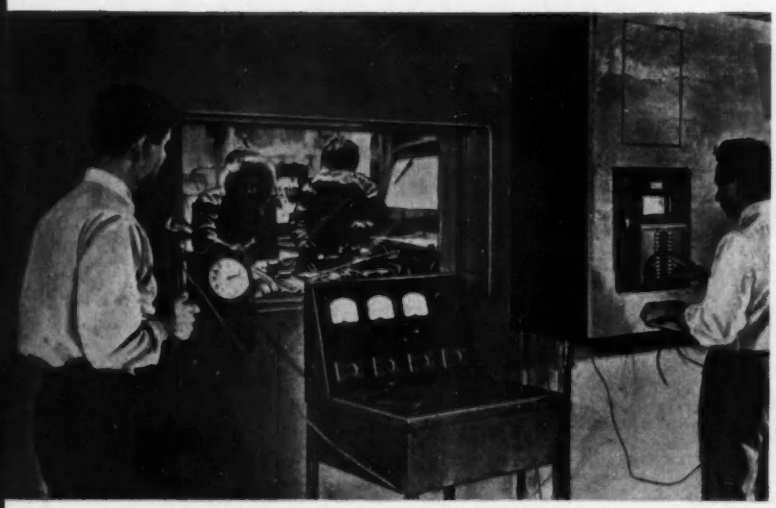
analytical instruments for science and industry

Dynamic Recording Systems

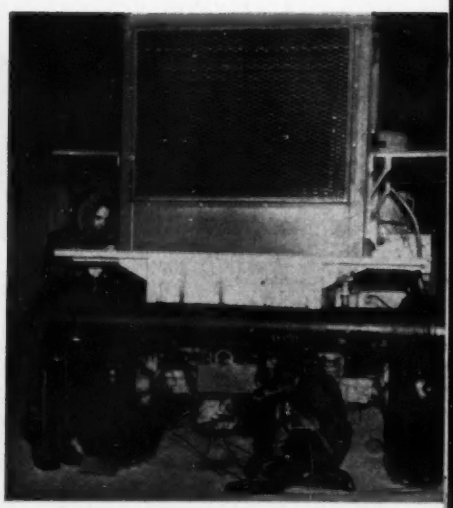
such as the one shown here have infinite variations in application and in the arrangement of the equipment. A typical recording system includes pickups, amplifiers, and a recording oscillograph. Write for Bulletin CEC 1500B.

America's finest

TESTS *ENTIRE* VEHICLE IN *CONTROLLED* SUB-ZERO WEATHER! Cuts down the time and expense of field-testing by getting rid of all the production, installation and operating "bugs" BEFORE winterization equipment is released for actual duty.



LOOKING THROUGH A 6-THICKNESS WINDOW INTO THE ARCTIC LABORATORY! Perfection engineers use two direct-reading and three automatic recording potentiometers connected to 96 thermocouples to completely thermocouple an internal combustion engine and its components.



BIG ENOUGH TO TEST TWO 60-PASSENGER BUSES AT TH SAME TIME! With nearly 1,000 sq. ft. of floor space in the Arct Laboratory, several tests can be conducted at the same time

new Arctic Laboratory

Perfection 90° below zero "cold weather" laboratory makes possible testing and winterizing of entire vehicles and equipment

That Jeep is being tested in the coldest man-made spot you can imagine . . . the new Perfection Arctic Laboratory where they can send the temperature down to 90° below to facilitate the development and testing of Perfection-built engine pre-heaters and winterization kits for combat vehicles and other equipment. It's the biggest Arctic Laboratory in the heating industry; one of the largest in existence.

Over 100,000 Successful Winterization Installations

For 10 years, Perfection engineers have worked continuously on the development and production of liquid-coolant, direct-fired-air and fresh-air heaters for sub-zero service in all types of vehicles and equipment.

Skilled Staff of Winterization Experts

Experienced in helping manufacturers and users in all phases of winterization or automotive heating, including starting and/or stand-by engine heating, personnel heating, space or cargo heating and heating for defrosting, Perfection engineers, scientists and technicians have worked on winterization projects in Alaska, on the Alcan Highway, in Korea and other low temperature regions. Write or wire for complete information. Perfection Stove Co., 7342-D Platt Avenue, Cleveland 4, Ohio.

Here's what we do:

1. Develop a winterization system and adapt heating equipment to it.
2. Apply it to the vehicle or equipment.
3. Test it to government specifications in our own Cold Rooms.
4. *Prove* that it meets those specifications.
5. *Guarantee* that the equipment will go at 65° below.
6. Make the drawings for your production or produce the systems for you.

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Perfection

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More than *150 million!* That's a *conservative* estimate of the number of shock absorbers produced by Delco in the last 23 years.

The combined *mileage* of these shock absorbers is unguessable. Many *billions*, certainly.

However astronomical the figures, they indicate something vastly important — they indicate an *experience* in shock absorber design, engineering and production that is *invaluable* to Delco's customers and prospective customers.

DELCO PRODUCTS

Division of General Motors Corporation, Dayton, Ohio

DELCO *Hydraulic Shock Absorbers*

When a high-strength steel is needed

for severe cold-formed shapes like these bumpers

Specify N-A-X HIGH-TENSILE STEEL

and get all of the requirements of SAE 950

When a material meeting the requirements of the high-strength, corrosion-resisting steels of SAE Specification 950 is used for severe cold-formed shapes, it will pay to investigate N-A-X HIGH-TENSILE steel—the low alloy steel with *built-in formability*. Its finer grain and higher hardness also result in brighter luster when ground and polished for plated parts.

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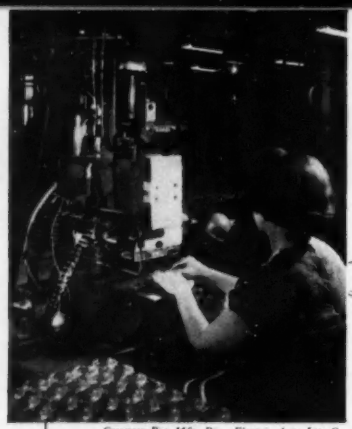
NATIONAL STEEL CORPORATION

Multi-colored plastic ornaments on automobiles were hand painted luxuries a few years ago. Now, with the help of a bit of Silastic, they are mass produced to decorate even the least expensive models.

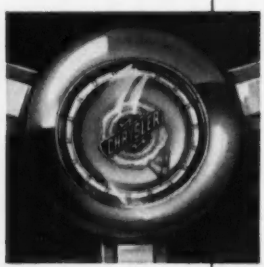


Courtesy Bay Mfg. Div., Electric Auto-Lite Co.

as a die for hot-stamping pigmented foil

SILASTIC* works

where other materials fail



One of the problems in developing this process was to find a material for hot-stamping pigmented foil. Specifications called for a die-tip that would remain resilient and not stick to the foil after thousands of impressions at surface temperatures in the range of 500° F.

After trying many materials, that problem was solved at the Electric Auto-Lite plant by using Silastic. For more than 3 years the same Silastic tips have been used, and none of them has worn out, lost its flexibility or peeled off its metal backup plate.

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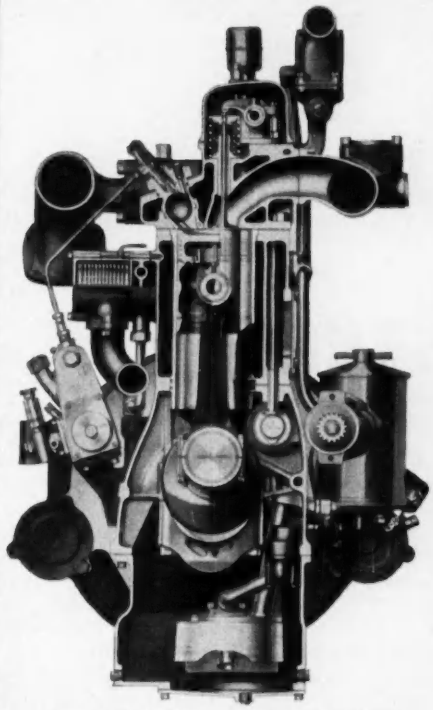

WAUKESHA High-Duty DIESEL Model 148-DK
six-cylinders, 5¼-in. bore x 6-in. stroke, 779 cu. in. displacement. Peak hp 200.

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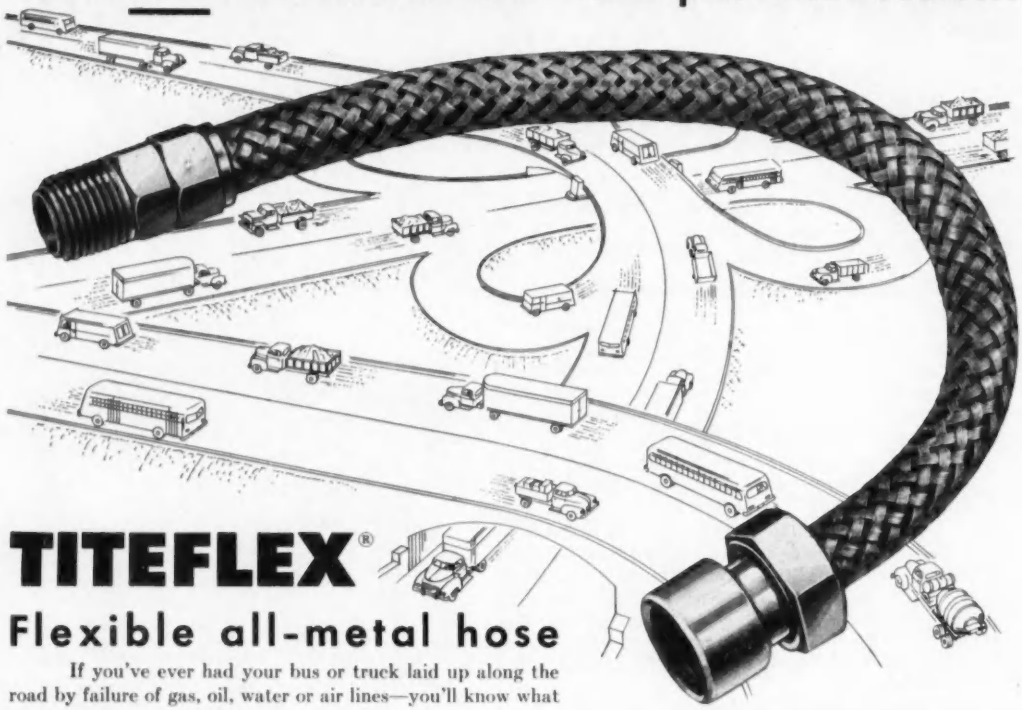

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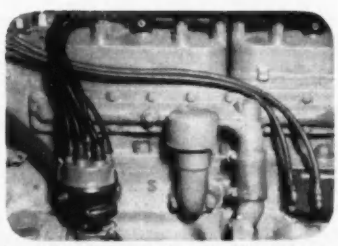

Four Wheel Drive cab-forward utility trucks use Titeflex for the fuel and oil lines of their automotive engines. These trucks operate over the roughest kind of terrain. Titeflex oil line (shown above) leads from the engine to gauges on the instrument panel. Photograph courtesy of Four Wheel Drive.

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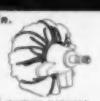

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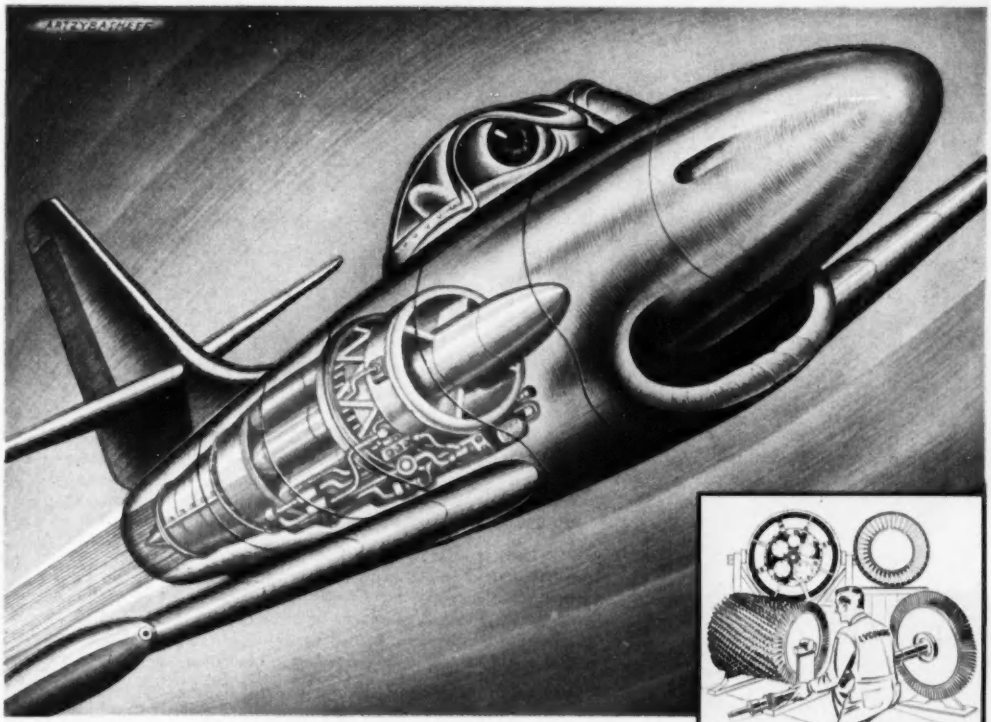

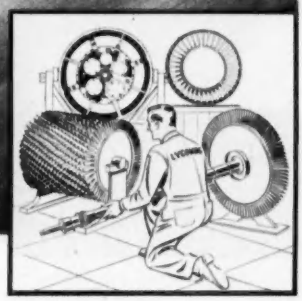

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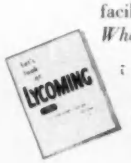
For major engine parts that put the "blast" in jets, **Lycoming is one of General Electric's leading sources of precision production.**



For a more complete story on Lycoming's varied abilities and facilities, write—on your company letterhead—for the interesting, illustrated booklet "Let's Look at Lycoming."

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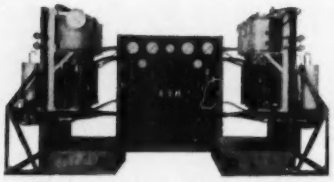
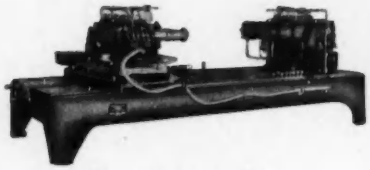
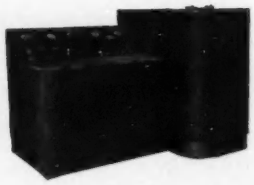


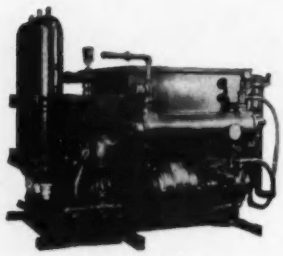
Universal Jet Fuel Nozzle Test Stand



Universal Torsional Shaft Tester

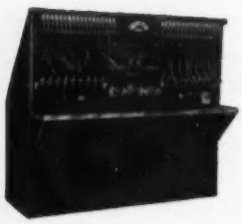


Universal Propeller Governor Tester



Rock Crusher Hydraulic Power Pack

Jet Engine Lube Pump Test Stand



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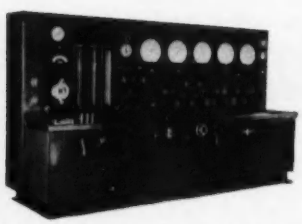
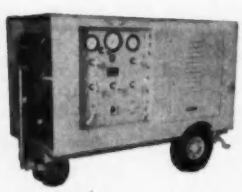
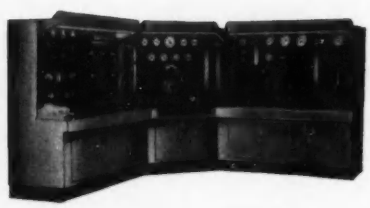


Master Hydraulic Pump Accessory Test Stand



Portable Hydraulic Test Stand



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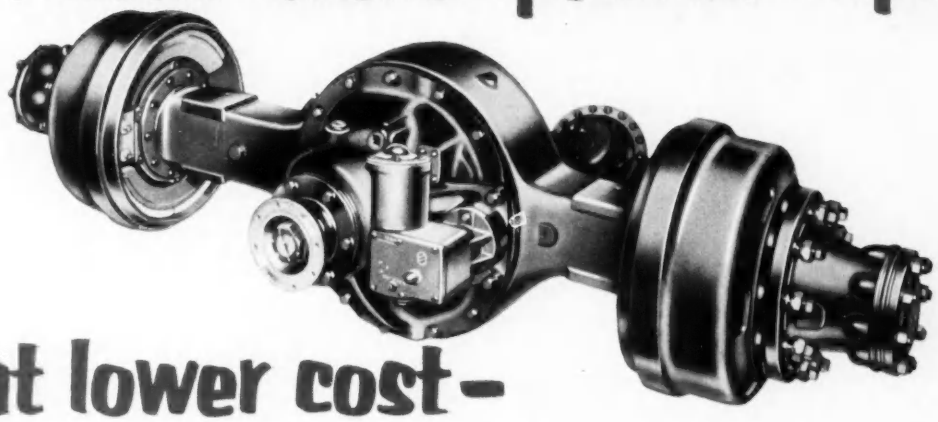
EATON 2-Speed equipped Trucks make quicker trips



at lower cost – last longer, are worth more on the trade-in

With Eaton 2-Speed Axles drivers select the gear ratio best suited to road, load, and traffic conditions—the ratio for maximum economy, safety, and maneuverability. Quicker trips with full loads mean more payload miles at lower cost per mile. Engines run in the most efficient and economical speed range, reducing stress and wear on engines and all power transmitting parts. Trucks stay on the job, out of the repair shop. Thousands of miles are added to vehicle life; trucks are worth more when they are traded in.

Performance records prove emphatically that Eaton 2-Speeds enable trucks to haul more, faster, longer, at lower cost.

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EATON MANUFACTURING COMPANY
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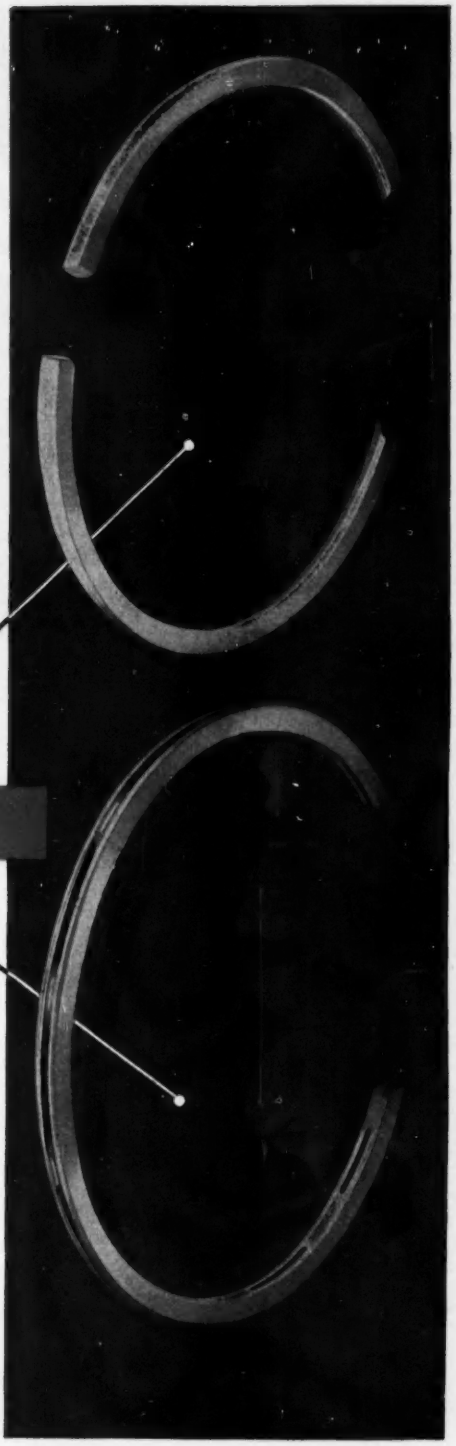

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Today, all types of Aetna products are regularly specified for key applications in the distinguished line of motor trucks, farm tractors, crawler tractors and other hard working power units bearing the IH emblem. Supplying these essential components by the hundreds of thousands on schedule, "on the nose" of exacting metallurgical, uniformity and tolerance "specs" and at prices that are right, naturally calls for top-flight technical and manufacturing skills as well as large-scale facilities. These abilities, we are proud to say, are Aetna's greatest assets . . . the down-to-earth reasons for today's pronounced preference for Aetna products amongst leading manufacturers in the Agricultural Equipment, Automotive, Oil drilling equipment and general industrial fields. Perhaps the things they like about us and our services would prove profitable to you. Possibly we could place a bearing or part you need in mass production—at a saving. Shall we talk it over? Aetna Ball and Roller Bearing Company, 4600 Schubert Ave., Chicago 39, Ill.

Aetna

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Four different ways leading manufacturers use the same standard-design oil seal

A widely used standard-design leather seal is the National 50,000 series oil and grease seal shown in Figure 1. The broad applicability of this design can be seen in the variety of ways it is used by different equipment manufacturers.

For example, in the rear clutch bearing of the Caterpillar DW-20 tractor (Figure 2) two National 50,000 seals are used. The seal at the inside position faces the ball bearing and prevents bearing grease from entering the clutch. The outer seal faces away from the bearing and seals on a coupling joining the splined drive shaft. Facing this seal outward permits flush lubrication of the bearing and guards against entry of dust, dirt or mud.

A similar use of the same seal is found in the hoist drum assembly of the Marion Type 93-M Power Shovel *(not illustrated)*. Here four large National 50,000 series seals are used at widely separated bearing positions. Two outer seals at extreme ends of the assembly are faced toward bearings to retain lubricant. Two inner seals are faced away from bearings to permit flush lubrication and afford extra protection from foreign matter.

Where space limitations are not extreme, these same seals can be paired to form a dual seal. An example is the pinion shaft assembly of the Hyster Hi-Speed Winch (Figure 3). Here two standard-design National 50,000 seals

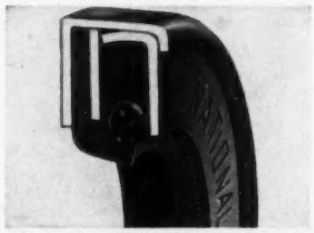

Fig. 1. National 50,000 Series Leather Seal

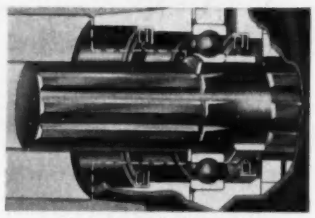

Fig. 2. Tractor Clutch Assembly

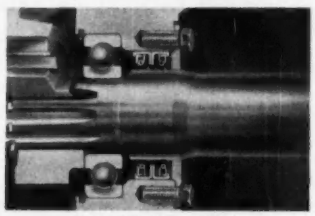

Fig. 3. Winch Pinion Shaft

Fig. 4. Drilling Rig Drum Shaft

are mounted back to back, fulfilling the function of a dual opposed seal. This same procedure may be followed where a dual tandem seal is required, as in the Emsco GB-800 oil field drilling rig (Figure 4). Here two National 50,000 series seals are mounted side by side, with sealing lips pointing in the same direction.

In each of these applications, National leather seals contribute to the dependable operation of the equipment. The extra heavy construction of these seals provides a margin of safety against inexpert field replacement. And since National leather sealing members retain lubricant within themselves, they can operate "dry" for some time, thus providing a margin of safety against lubrication neglect. National 50,000 series leather seals are available for many standard bore and shaft sizes. For complete information, write direct to factory or to the National Oil Seal engineer nearest you.

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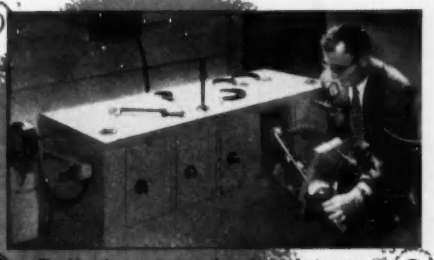
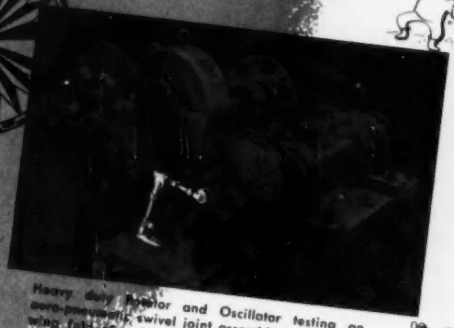


Checking the temperature of an aircraft test assembly in the High Temperature Chamber at 200° F.



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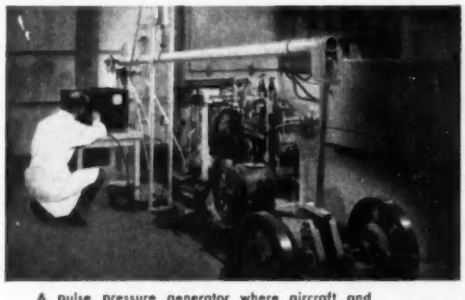

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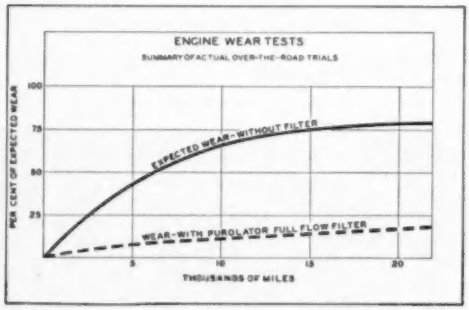

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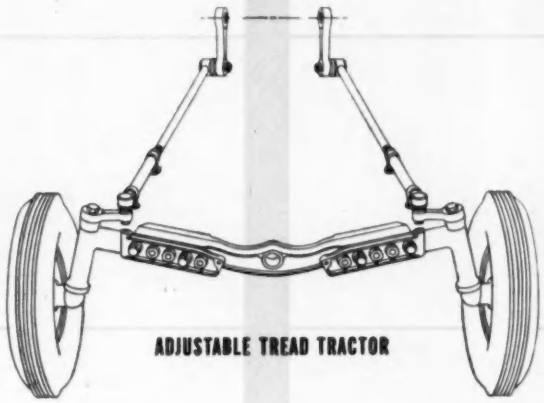

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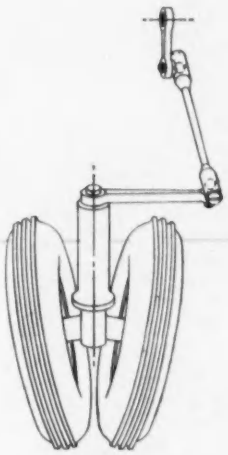

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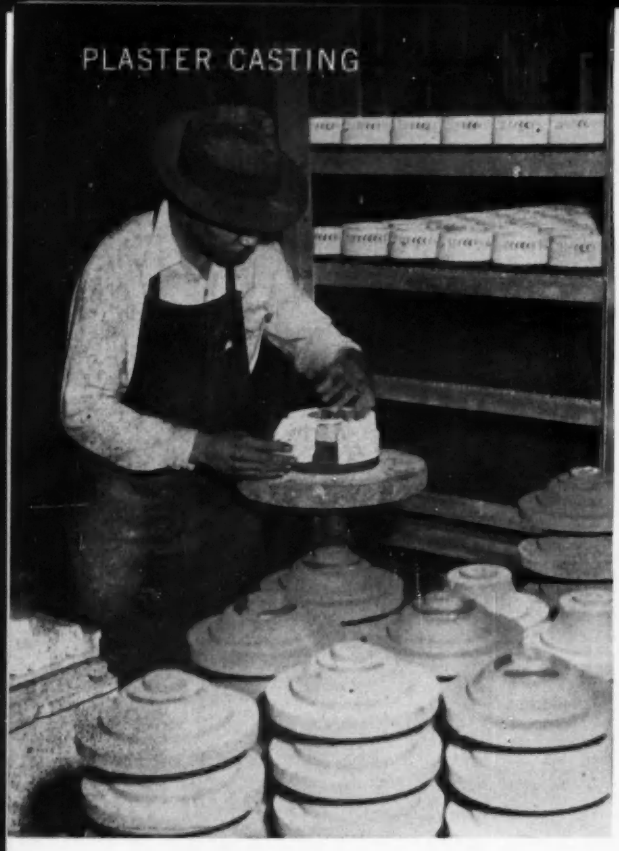

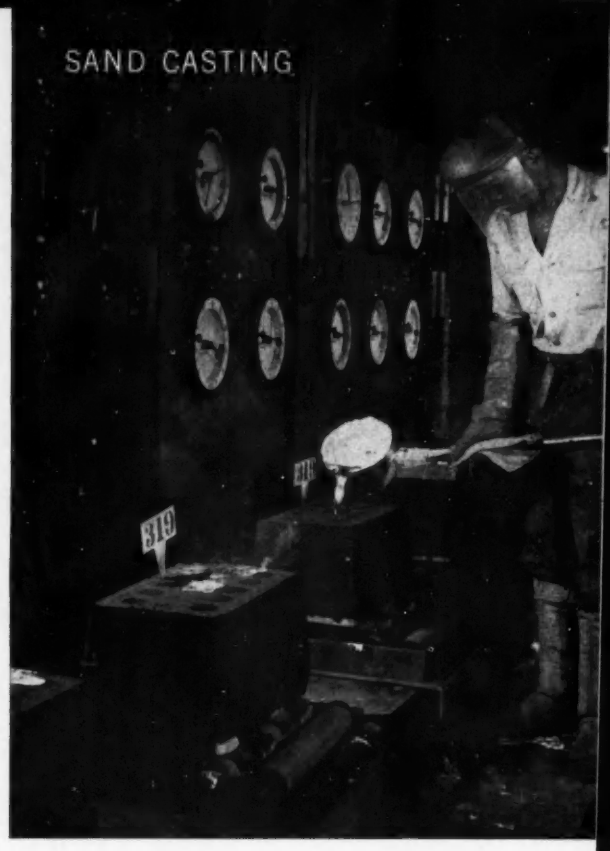

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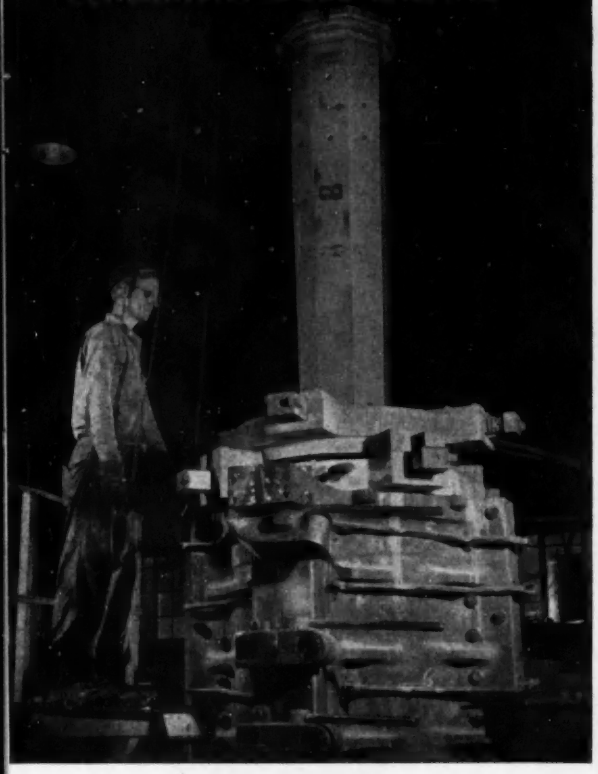

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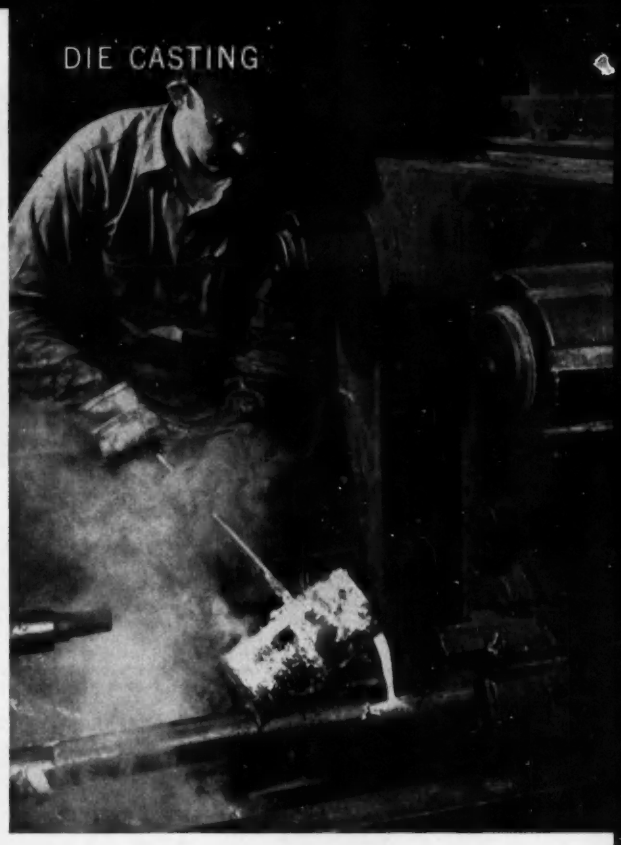

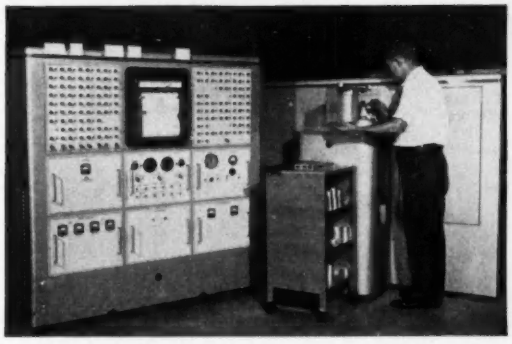

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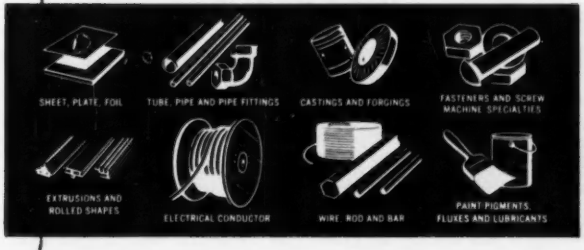

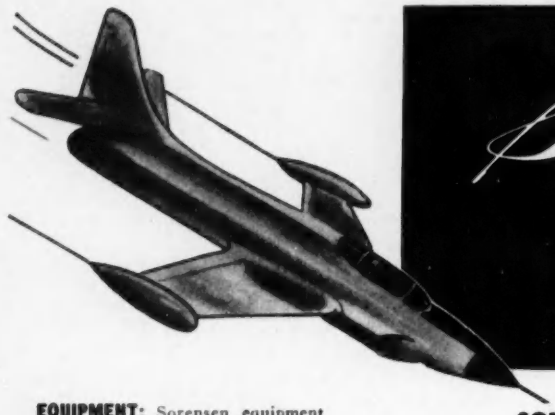

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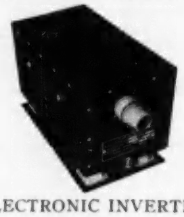

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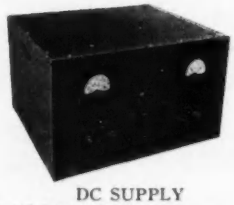

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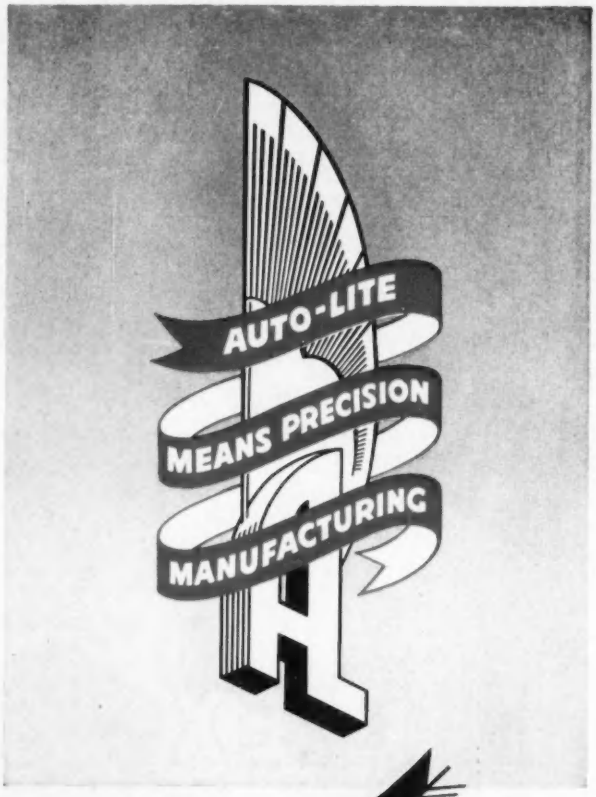

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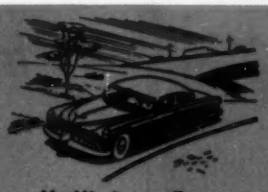

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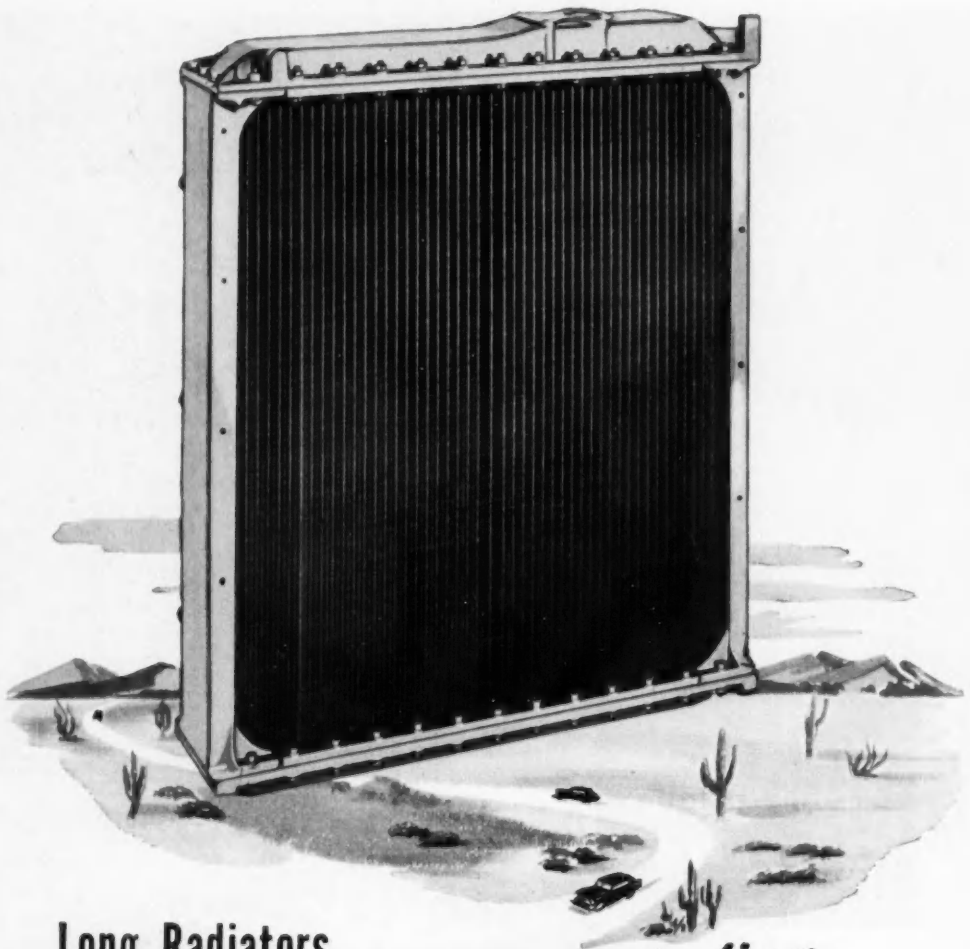

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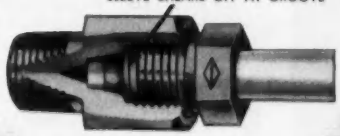

★ **For Tubing ⅛" to ¾" O.D.**

★ **Available in Brass or Aluminum**

★ **Ask for Bulletin No. 3002**

Easier and Quicker to Assemble

Fitting comes with nut assembled. To get a tight joint, simply insert tube into fitting and tighten nut. No loose sleeve to drop . . . no flaring required. Makes repeated tight reconnections.

With IMPERIAL you can be sure of the finest in fittings . . . fittings that have *forged* bodies on elbows and tees providing greater strength and toughness . . . *long* Dryseal pipe threads for extra assurance of tight pipe connections. See Catalog 350.

THE IMPERIAL BRASS MANUFACTURING COMPANY

1225 W. Harrison St., Chicago 7, Illinois

In Canada: 334 Lauder Ave., Toronto, Ontario

IMPERIAL

Pioneers in Tube Fittings and Tube Working Tools

THE SEAL OF
COOPERATIVE
RESEARCH

C/R

In cooperation with DEERE & COMPANY

The JOHN DEERE SURFLEX TILLER WORKS UP TO 130 ACRES A DAY. DEPENDABLE UNDER ALL CONDITIONS

This John Deere 20-foot Surflex Disk Tiller is a remarkable farm machine. It tills up to 130 acres a day. Over hilly, uneven fields or on flat land, its penetration is uniform . . . exacting the maximum from every acre in every field condition.

Surflex dependability grows from Deere & Company's exhaustive care in the design, development and manufacture of each part of the unit. Each of the disk bearings, for example, is protected by a C/R Type "V" diaphragm oil seal with a leather sealing surface. Obviously, these seals must exclude every trace of the ever-present dirt in which the tiller operates.

As is the case with all C/R "Perfect" oil seals, those for the John Deere Surflex Disk Tiller were developed in cooperation with the manufacturer's engineers.

Each C/R seal is designed to do a specific job of protecting bearings under a variety of tough operating conditions. And, each C/R seal does that job as well as it can be done.

That's why, when you have a problem of lubricant retention, or foreign matter exclusion, it will pay you to check with C/R engineers *first*.

P. S. For immediate delivery, C/R "Perfect" oil seals are stocked in over 1800 sizes covering 15 different types.

The cooperative research and engineering services which C/R has provided in producing special C/R oil seals (both synthetic rubber and leather) for leading manufacturers are available to you. We will be pleased to send you any information you wish. Brochure on request.

C/R

Oil Seals

sirvis

Mechanical Leather Products

Boots, diaphragms, packings and other products give dependable service under difficult operating conditions.

SIRVENE

The Scientifically Compounded Elastomer

Custom-engineered and custom-built for critical service in aircraft, automotive and other mechanisms.

Representatives in these Principal Cities

Boston • New York • Syracuse
Philadelphia • Pittsburgh • Cincinnati
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Minneapolis • Kansas City • Houston
Los Angeles • San Francisco

THERE IS PLENTY OF TIN IN MALAYA

Only a deliberate distortion of facts could give rise to the false impression that tin is in short supply.

You should know the truth.

We have prepared a 20-page booklet that graphically and concisely presents the complete story. A copy is yours for the asking.

THE MALAYAN TIN BUREAU

Department 42

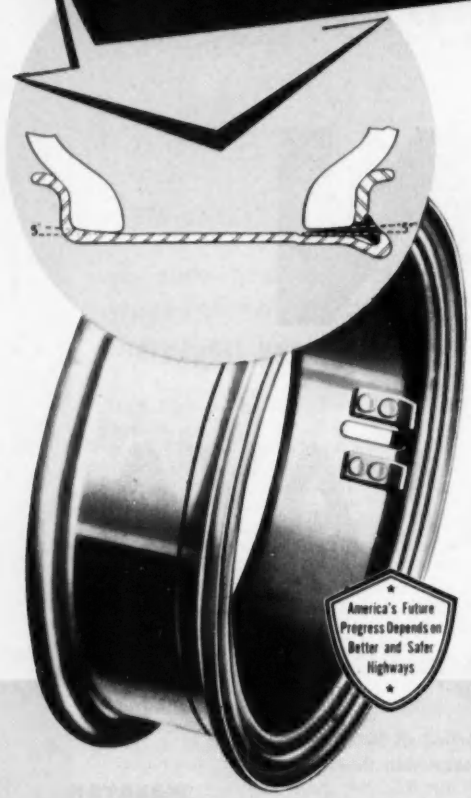
1028 Connecticut Avenue Washington 6, D. C.

There Is Plenty of Tin in Malaya

Here's Another Reason Why

TRUCK TIRE MILEAGE IS GREATER

WITH Firestone ADVANCED RIMS



A truck tire on a Firestone R-5° Advanced Rim sits firmly on the rim with *full width 5-degree solid support* under BOTH beads. This keeps the tire from rocking or wobbling, stops bead chafing and avoids excess body strains. As a result the tire body stays strong and serviceable much longer, providing full original tread mileage plus more retreads than ever before.

Trucks equipped with Firestone R-5° Advanced Rims pay dividends in lower tire costs on every operating mile. No wonder operators are sold on trucks equipped with Firestone R-5° Rims.

Firestone Advanced Rims are available in all sizes in both demountable and non-demountable types. For complete information write to Firestone Steel Products Company, Akron, Ohio.

Here's a Rim That's EXTRA Safe!

The locking ring of the Firestone R-5° Rim is held firmly in place and is actually forced down into the rim gutter by the tire bead as it becomes seated. Even if the side ring is not in place when the tire is inflated, the *locking ring cannot blow off.*

FULL WIDTH 5° TAPERED SUPPORT UNDER BOTH TIRE BEADS

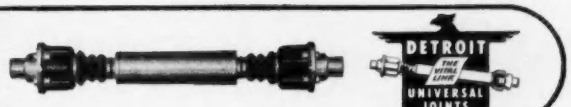
Copyright, 1952, The Firestone Tire & Rubber Company

Long Life of "DETROIT" Universal Joints...

...Proved By Grueling Tests

"DETROIT" Universal Joints are continuously subjected to many tests far more severe than actual road service. These constant checks assure superior quality and engineering of "DETROIT" Universal Joints.

DETROIT
UNIVERSAL JOINTS



UNIVERSAL PRODUCTS COMPANY, Inc., Dearborn, Michigan

CONVAIR P5Y Uses NEW LORD TURBO MOUNTINGS

To Isolate Vibration of 22,000 Shaft Horsepower

This is the world's first turboprop water-based aircraft (U.S. Navy) flying over San Diego bay. The vibration of 22,000 Shaft Horsepower, the contra-rotating propellers and the gear boxes is isolated from the airframe through the use of 6 Lord Mountings on each of the 4 gear boxes.

Each of the 4 duel engines is also Lord Mounted.

The Navy's new P5Y water-based aircraft is used for long range search-rescue and anti-submarine patrol missions. The world's first turboprop water-based aircraft is equipped with the world's first Lord turbo power plant mounting . . . a typical example of the manner in which Lord experience and research serves manufacturers of aircraft. Lord Engineering capabilities team up with precision manufacture to protect aircraft, to lengthen engine life, to increase crew comfort and alertness by isolating destructive vibration and shock. Regardless of the industry in which you are battling with vibration and shock, it will pay you to call in Lord Engineers.

FIELD ENGINEERING OFFICES—

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DALLAS, TEXAS
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PRospect 7396

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725 Widener Building
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1635 West 12th Street
2-2296

LORD MANUFACTURING COMPANY • ERIE, PA.

LORD BONDED RUBBER

Headquarters for VIBRATION CONTROL

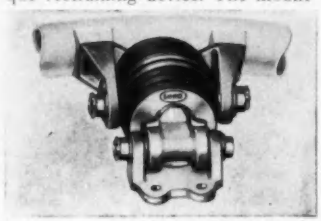
Lord Engineering Design Solves Unique Dual Vibration Problem in Mounting 22,000 Horsepower

Two distinct vibration isolation problems were present in mounting the 4 Allison remote-coupled T40 Turboprop Power Plants used in the Convair P5Y.

First, the vibration set up by the 14,300 r.p.m. of the turbine engine required a mounting system which would isolate first order engine disturbances. This was done using a stable mounting system with relatively small deflections for the power section alone.

Second, the operation of the propeller at 870 r.p.m. required a relatively soft, large deflection, mounting system for proper isolation of the remote gear box. However, the permissable misalignment of the flexible shafting from the power section to the gear box restricted mounting motions to narrow limits.

The problem was solved by using a soft, Lord Dynafocal type mounting system in conjunction with a torque restraining device. The mount-



ing system provides good isolation in the vertical, lateral, pitch and yaw modes. In the roll direction, the torque restrainer holds the engine from moving under torque loads. Thus critical vibration is isolated and gear box motions held within tolerance.

In addition, the mounting system provides positive snubbing, preventing the gear box from deflecting beyond the shaft input misalignment limits under transient overloads.

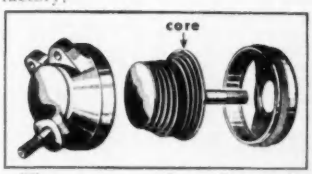
Thus, in brief, the analysis and subsequent attack of this unusual dual vibration problem by Lord Engineers provided the required isolation where extremes of vibration frequency and motion were encountered.

Further details on this and other difficult vibration isolation problems are available to those who write to Lord Manufacturing Company, Erie, Pa.

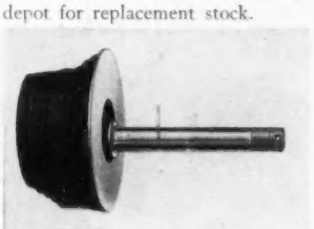
Lord Core Renewal Service Reduces Engine Maintenance Costs

Consistent with good airline maintenance practice, the Lord Manufacturing Company, Erie, Pa. has instituted a core renewal service on Lord Dynafocal Suspensions which is effecting material savings for airlines.

This service enables airline maintenance men to remove used cores from engine mountings, replace them with the stocked spares and return the old cores to the Lord factory.



The cores are immediately inspected, classified and checked by the Lord inspection department where the old rubber is removed and the metal is thoroughly cleaned. The metal parts are carefully inspected a second time to be sure they are in perfect condition. Then new rubber is bonded to the metal parts, resulting in the equivalent of brand new cores. They are then returned to the airline maintenance depot for replacement stock.



The result of this Lord service is a material saving in parts and in replacement time. Stocking sufficient numbers of spare cores promotes prompt replacement when required —but renewal of rubber in old cores saves sizeable amounts on the overall maintenance budget.

The Airlines welcome this field proved procedure of renewing cores. Old parts are returned and credit applied to the cost of the rebonded core, thus substantially lowering mounting maintenance costs.

Further details are available to interested airlines by writing Lord Manufacturing Company, Erie, Pa.

44 LEADING AIRLINES
INCREASE PAYLOAD
By Using LORD Mountings
Convair-Liner 340
Typical of the Lord Mountings used by the world's leading Airlines today, are the MR-363 lightweight Mountings on the new Convair 340 engine.
Pratt-Whitney R-2800 CB-16 Engines push the powerful Convair 340 lightweight, low-cost Lord Mountings increase the payload approximately 16 lb. per engine . . . protect the airframe from vibration . . . give passengers a smoother ride.

Lord Vibration Control Mountings are increasing payloads, protecting airframes, instruments and accessory equipment . . . adding to the comfort of passengers on 44 of the World's Leading Airlines. Why? Because Lord Engineering experience and manufacturing capabilities are providing light weight, low-cost mountings which contribute much to profitable airline operation. Lord engineering capabilities are being used to advantage by design engineers throughout world industry in their battle to isolate vibration and shock in a wide diversity of machines. Consult with Lord Engineers even before design takes shape on the board . . . and in perfecting machines already operating . . . You will profit.

FIELD ENGINEERING OFFICES—

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LORD MANUFACTURING COMPANY • ERIE, PA.

LORD BONDED RUBBER

Headquarters for
VIBRATION CONTROL

20th National Exposition of Power and Mechanical Engineering
Grand Central Palace, N. Y., Booth No. 558, December 1-6, 1952

MACHINES MOUNTED ON

Westsorb CAN'T CRAWL

Westsorb *adhesive-coated* machine mounts are solving more than the problem of vibration. Their (exclusive) adhesive coating on both sides prevents looms and all other machinery from "crawling." Eliminates realignment after installation. This minimizes down time—saves money. Westsorb adhesive-coated felt mountings don't break down under heaviest service impacts. They resist oil, acid, grease, water and age. They are simpler to install than any machine pad. No holes or bolts—no adhesive to apply. Western Felt engineers located throughout the textile areas are anxious to cooperate.

WESTSORB

Vibration-absorbing Machine Mounts

• Quickly installed • No holes to drill • No adhesive to apply
Low "down-time" • Saves floors • Less machine repair • Reduce plant noise • Thickness for every need • Engineered for every job

WESTERN Felt WORKS

4035-4117 Ogden Ave.
Chicago 23, Illinois
Branches in all Principal Cities

MANUFACTURERS AND CUTTERS OF WOOL FELTS

GET THIS DATA

Western Felt Works
4035-4117 Ogden Ave., Chicago 23, Illinois

Please send 18-page booklet containing data on efficiency tests of Westsorb machine mounts under looms and other equipment.

Company .....

Address .....

Individual ..... *Title* .....

ENGINEERS:

We've Got what you're Looking for!

T. H. Beck, Manager of Engineering. Is an engineering veteran of over 22 years in the aviation and related industries.

A secure future, exceptional opportunities for advancement, and a high starting salary await you at FAIRCHILD. We have openings right now for qualified engineers and designers in all phases of aircraft manufacturing; we need top-notch men to help us in our long-range military program: turning out the famous C-119 Flying Boxcar and other projects for the U.S. Air Force.

FAIRCHILD provides paid vacations and liberal health and life insurance coverage. We work a 5-day, 40-hour week as a base. Premium is paid when longer work week is scheduled.

ENGINE AND AIRPLANE CORPORATION
FAIRCHILD *Aircraft Division*
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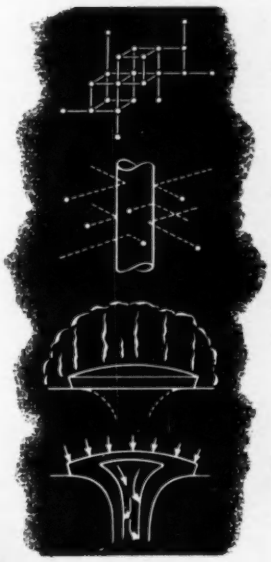
4 Thompson firsts that make T.P.M. valves best

Thousands of Thompson T.P.M. Valves are piling up amazing service records in military and commercial aircraft engines. Hundreds of hours of severe service leave T.P.M. Valves looking literally as good as new. Time between valve overhauls is lengthened. Maintenance costs are reduced, lost flight-time due to valve failures has been practically eliminated.

Here's why . . .



ALLOY

T.P.M. is the new valve material developed by Thompson to give greater corrosion resistance and higher strength.

SHOT PEENING

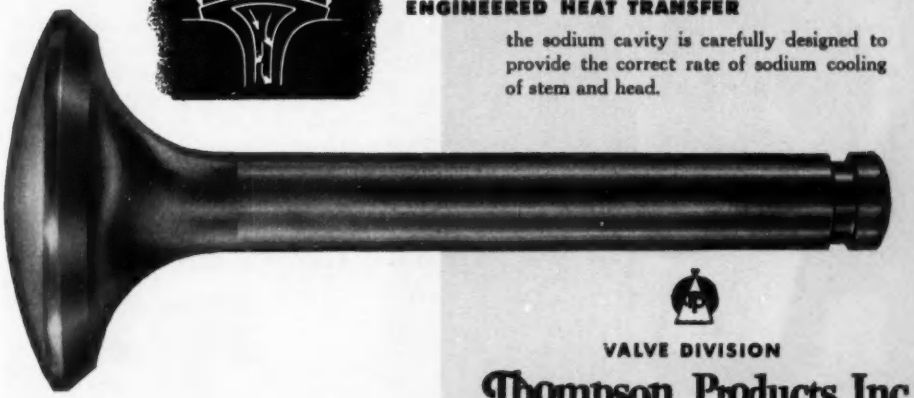
mechanically hardens T.P.M. stems to provide longer service with less wear.

CONTROLLED ATMOSPHERE

application of a Thompson-developed hard-facing material by arc-weld, assures a tough, homogeneous layer to resist high head temperatures.

ENGINEERED HEAT TRANSFER

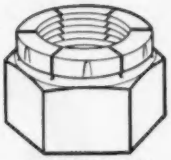
the sodium cavity is carefully designed to provide the correct rate of sodium cooling of stem and head.



VALVE DIVISION

Thompson Products, Inc.

CLEVELAND 17, OHIO



FLEXLOC Self-Locking Nut

"What are Flexloc locknuts?"

"They're nuts that hold assemblies together, and they just won't work loose like ordinary nuts."

Nuts that loosen are headaches, or even worse, because they may necessitate shutting machines down. When that happens, production flops, assembly lines stop, and delivery promises are not kept. FLEXLOC locknuts offer a simple solution to such problems—they don't work loose. And though they stay put, they can easily be removed with a wrench when necessary.

Standard FLEXLOC Self-Locking Nuts have a higher tensile value than most other locknuts. They're not affected by temperatures up to 550°F. Their torque is controlled within such narrow limits that they have been used successfully on plastic studs. FLEXLOC locknuts are stop nuts, too. They lock when you stop turning them—they don't have to be seated.

Increased capacity now enables us to make quantity shipments of FLEXLOC locknuts in a wide range of sizes. Write for literature and samples. STANDARD PRESSED STEEL Co., Jenkintown 55, Pa.

FLEXLOC LOCKNUT DIVISION

sps

JENKINTOWN, PENNSYLVANIA

The SOFT Acting Clutch with the SURE GRIP!

. . . just like a
Hand of Steel
in a
Velvet Glove

The hand of steel in the Lipe Clutch has 20 fingers that equalize the pressure of a single spring—assuring softer engagement and positive grip.

LIPE
MULTI-LEVER
CLUTCH

Lipe's soft-engagement, positive-grip Multi-Lever Clutch never needs babying. It engages smoothly—without grab, shock or jerk. All parts of the pressure plate touch at the *same instant* with the *same* pressure. There's no cocking—no point of high slippage and spot burning.
Result: *More mileage between tear-downs.*

Write for Service Manual and complete data on genuine Lipe parts—stocked in principal cities.

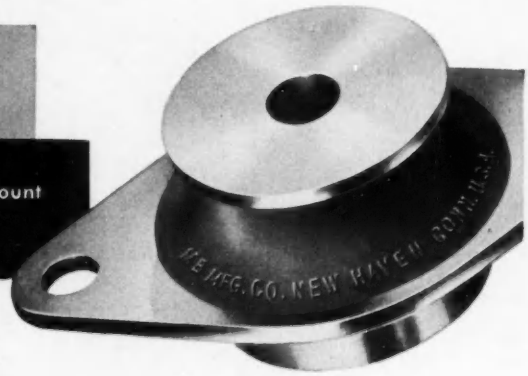
LIPE ROLLWAY

Lipe-ROLLWAY CORPORATION
Manufacturers of Automotive Clutches and Machine Tools
Syracuse 1, N. Y.

Vibration Engineering that solves your problems

PROBLEM: To provide superior vibration control while simplifying suspension design

SOLUTION: The Isomode* Type 5 Mount that isolates all modes of motion



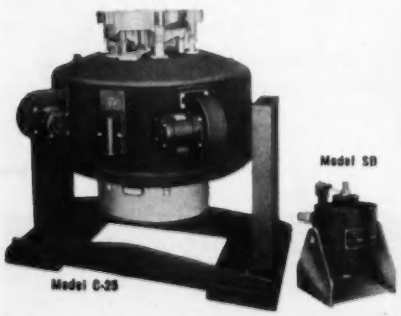
HOW to get optimum isolation into a product design? The answer is not always easy. But it was made much easier to find when Isomode Mounts were developed. They offer what's needed for outstanding results—namely, control of horizontal and rocking motions as well as vertical vibrations.

And here's why. Isomode Mounts have equal spring rates in all directions. They therefore absorb vibrations from all directions equally well. As a result, they can be mounted at any angle, permitting location of ideal suspension points and simplifying design.

In addition, Isomode Mounts have high load capacity in compact size, saving both space and weight. Large rubber volume for their size lends softness for good isolation, yet the mounts are stable, self snubbing and long lasting.

These mounts are an example of the kind of vibration engineering put to work for you at MB. Many companies have found it good practice to make MB their headquarters for vibration information. You will too—on vibration *isolation, control, testing, detection* or *measurement*. For more details on Isomode Mounts, be sure to write for Bulletin 410-7.

*Trade Mark Reg. U.S. Pat. Off.



A vibration exciter to meet your needs

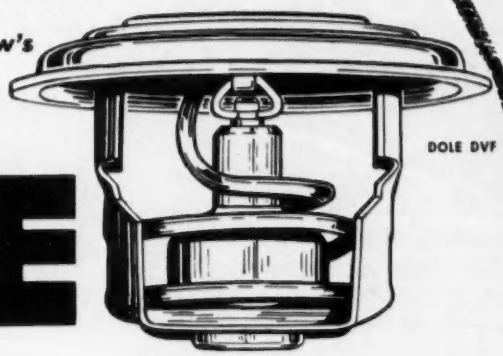
Whether your shake testing requirements are of large order or small, there's an MB Shaker for the job. Model SD, for example, has rated force output of 10 pounds; while the C-25 provides 2500 pounds. Model also available for 10,000 pounds. So if you have to vibration test to MIL-E-5272, be sure to check up with MB. Bulletin No. I-VE-7 gives technical data on MB Shakers. Write for it.

THE MB MANUFACTURING COMPANY, INC.
1060 STATE STREET, NEW HAVEN 11, CONN.

PRODUCTS AND EQUIPMENT TO CONTROL VIBRATION • TO MEASURE IT • TO REPRODUCE IT

Plus Performance

for temperature control of engines with pressurized cooling systems: for today's and tomorrow's cars and trucks



DOLE DVF

DOLE

"DV" Thermostats

DOLE DV THERMOSTATS used in leading makes—have proved their dependability and capacity to operate positively against the higher pump pressures in modern sealed cooling systems.

DOLE DV THERMOSTATS are also more efficient for the modern cars with open cooling systems.

In a word, DOLE DV THERMOSTATS help *all* cars of advanced design to give top performance—quick warm-up, savings of gasoline, oil and motor wear. Plus, of course, quick heat from the car heater.

Dole Thermostats are available in various sizes and models to meet all installation requirements.

DOLE DV 1

DOLE DV 2

DOLE DV 3

CONTROL WITH DOLE

THE DOLE VALVE COMPANY • 1901-1941 Carroll Avenue, Chicago 12, Illinois • Detroit • Los Angeles • Philadelphia

50,000 BTU's an hour

1 engine pre-heating

Floods engine components, battery, crankcase, carburetor with hi-velocity warm, dry air. Makes starting easier, faster, positive – even at 65° below!

2 personnel heating

Warm air – plenty of it – independent of engine operation – circulates swiftly, evenly to keep personnel comfortable and more efficient!

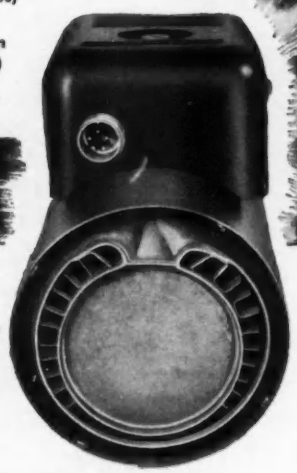
3 windshield defrosting

Keeps windshield reliably "frost-free." Assures clear vision, safer driving at all times – completely independent of engine operation!

Model 1030

overall– physical size

Weight (lbs.)	23
Height (inches)	8-3/4
Length (inches)	16-5/8
Width (inches)	6-7/32
Installation space (ft³)	.523



South Wind brings you all 3 with this...

compact new heater

• Never before has so small a heater afforded such wide application – *such amazing output of heat* – as this new South Wind heater. Now, this truly compact unit, designed to meet military specifications, is available to assure maximum vehicle and personnel efficiency under the most stringent weather conditions.

Versatile! Offers equal performance for trucks, stationary engines, air-cooled and liquid-cooled engines. **Powerful!** The most powerful heater for its size in the world with a useable output of 50,000 BTU's per hour! **Adaptable!** Burns gasoline, jet fuel or kerosene. Simplified operation! Easy to install! **Reliable!** Even under the toughest operating conditions, heat, and plenty of it, is assured – immediately!

Write Today for specific model information or experienced counsel on *any* phase of heating. Address inquiry to South Wind Division, Stewart-Warner Corporation, Indianapolis 7, Indiana.

South Wind

REG U S PAT OFF

A PRODUCT OF SW STEWART WARNER

PERSONNEL HEATING
ENGINE AND EQUIPMENT PRE-HEATING
WINDSHIELD DEFROSTING

You wouldn't buy a truck today with oil lamps!..

...Don't buy a truck without HYPOID axle gearing!

Oil lamps on a *modern* truck? You'd have no part of them! But why stop there? The axles that carry, move and stop the load are *much more important.* Make sure they're dependable Timken-Detroit Axles with *modern* Hypoid Gearing!

This rugged axle gearing is built for the modern truck—built to operate at peak efficiency, day after day, under the toughest conditions. And this is no idle boast. Hypoid Gearing has been *tried* and *proved* by billions of ton-miles of operation. You'll find, too, that Hypoid Gearing adds miles to the life of your truck at lower maintenance costs!

The next time you buy a truck, make sure the all-important axles are as modern as the rest of the vehicle. Specify Timken-Detroit Axles and Brakes!

Go MODERN Go HYPOID

The offset Hypoid pinion is bigger and stronger. Bearings are bigger. More teeth are in contact, reducing loading per unit of contact area. Torque-transmitting capacity is increased. Slower gear ratios are practical without loss of strength.

Only Timken-Detroit offers Hypoid Gearing in all three types of final drives . . . single-reduction, double-reduction, and two-speed double-reduction . . . in a complete range of capacities.

TIMKEN Detroit AXLES

A PRODUCT OF THE TIMKEN-DETROIT AXLE COMPANY

DETROIT 32, MICHIGAN

Accepted SAE Standard

TRADE MARK REGISTERED

The best-engineered trailer axles on the road come from Timken-Detroit!

This modern manufacturing plant, located at Kenton, Ohio, houses the Trailer Axle Division of The Timken-Detroit Axle Company.

Timken-Detroit *knows* trailer axles! More than 40 years' experience in building axles for trucks, buses and trailers attest to that! Furthermore, nine great plants—one of which is devoted to developing and producing trailer axles—are provided with every modern engineering, research and production facility. Highly trained technicians are constantly at work improving the materials, design and workmanship that go into every trailer axle produced by Timken-Detroit. Months, and often years, are spent in developing and testing axles before they ever leave the blueprint stage. In the trailer axle field, too, Timken-Detroit knows its business!

WORLD'S LARGEST MANUFACTURER OF AXLES FOR TRUCKS, BUSES AND TRAILERS

PLANTS AT:

DETROIT AND JACKSON, MICH. • OSHKOSH, WIS. • UTICA, N. Y.
ASHTABULA, KENTON AND NEWARK, OHIO • NEW CASTLE, PA.

TIMKEN Detroit AXLES

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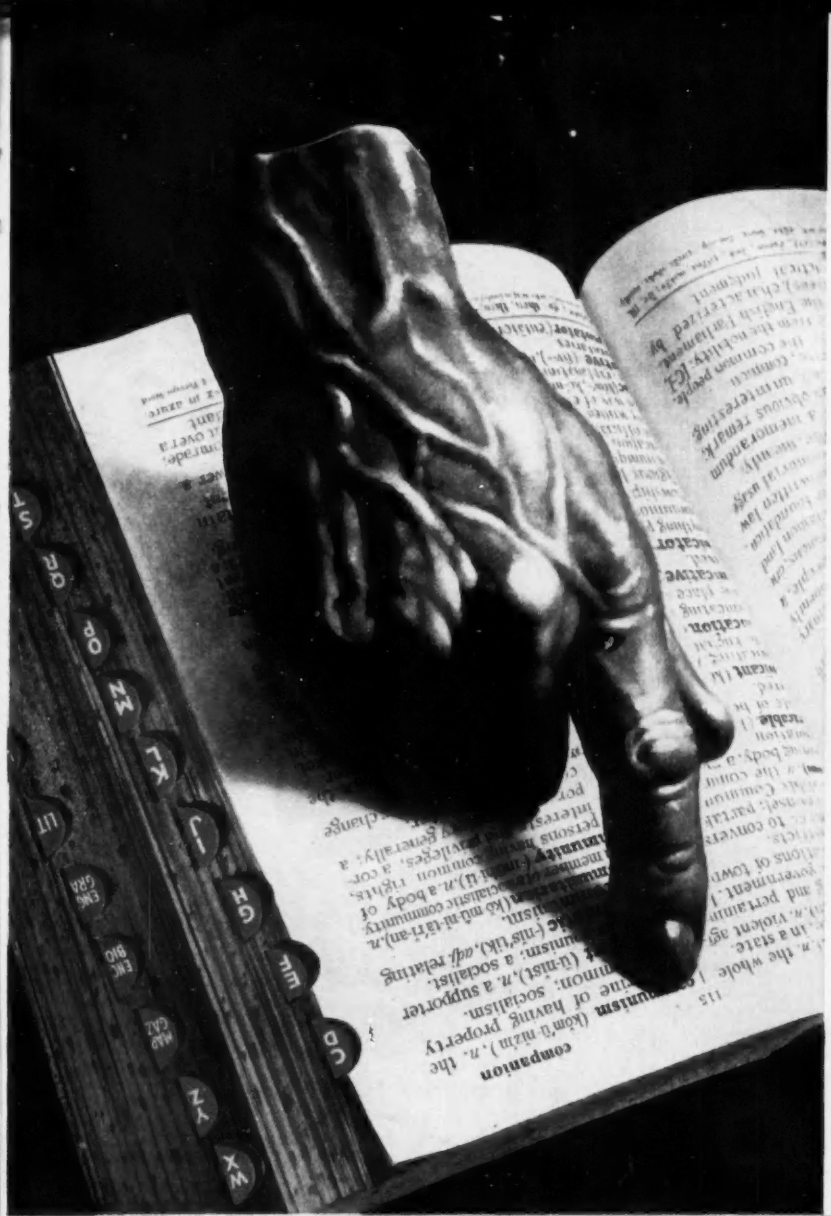

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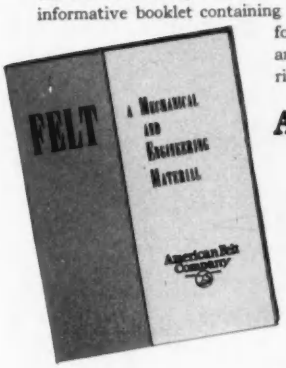

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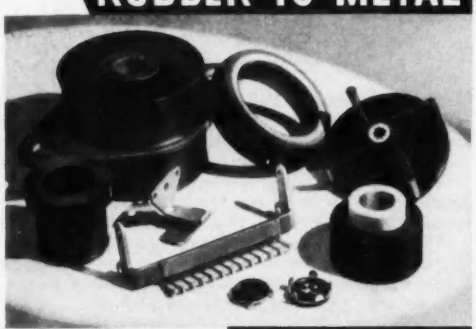

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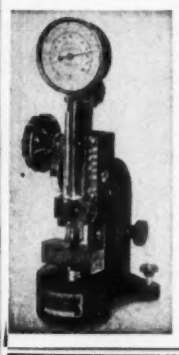

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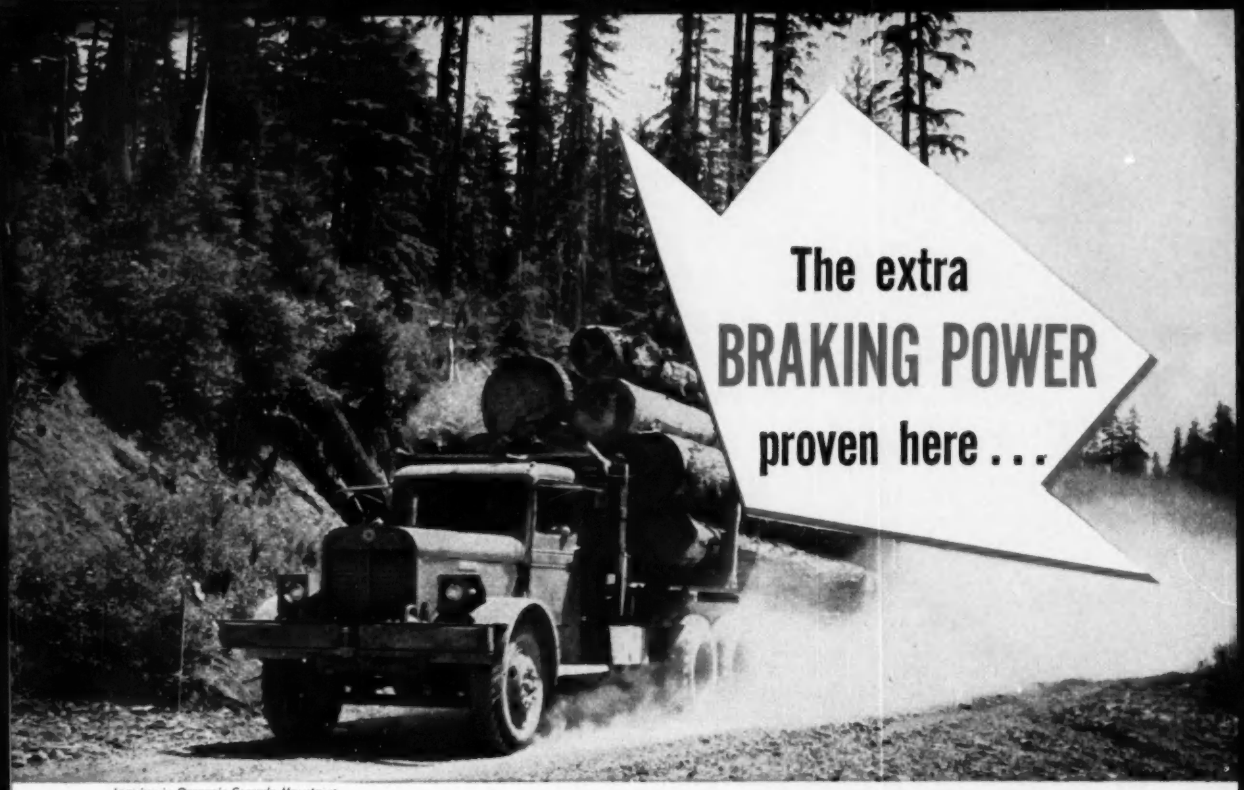

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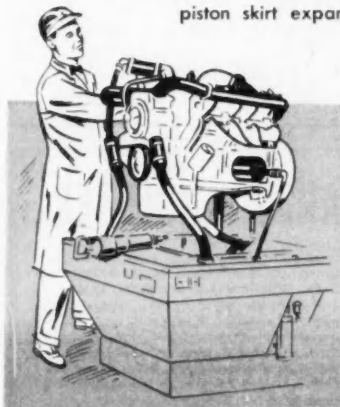

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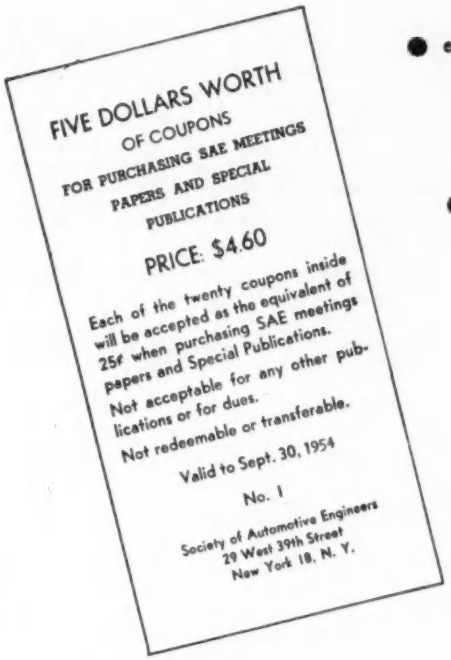
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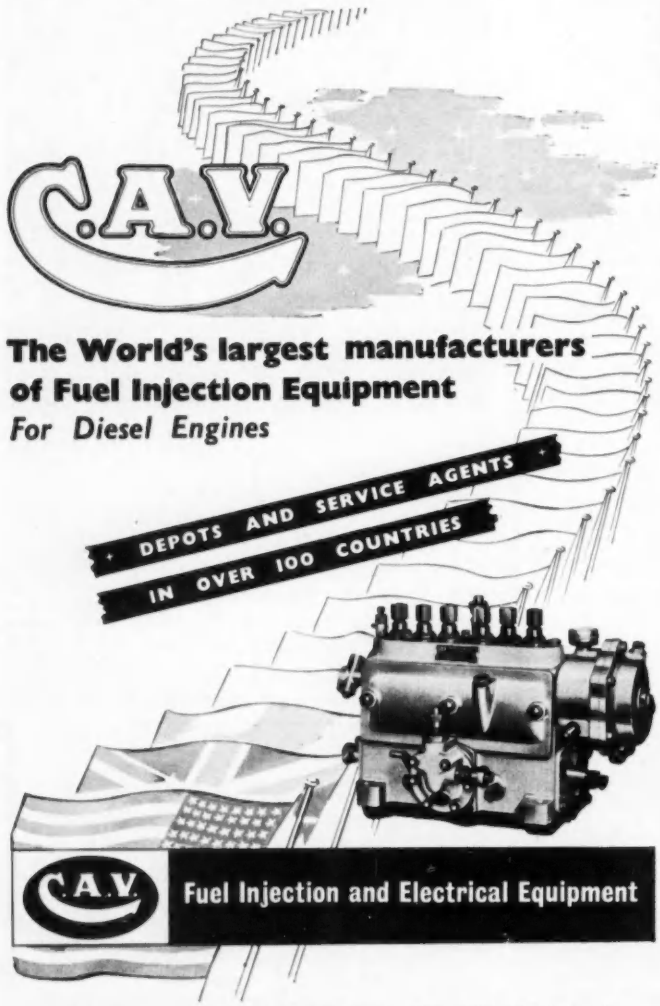
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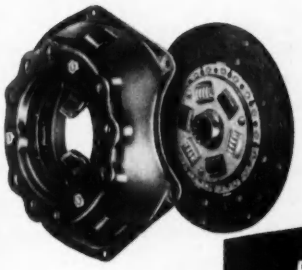

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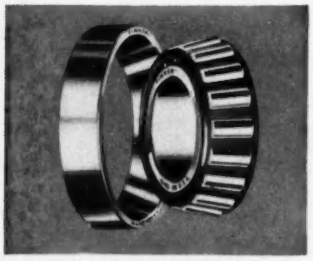

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